Engineering Library

OCT 23 1929

The Engineer.

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VOL. CXLVIII.—No. 3848] LONDON: FRIDAY EVENING, OCTOBER 11, 1929 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Wednesday, 30th October, 1929, for ACCELERATED LOW-PRESSURE HOT WATER HEATING at the Sorting Office, &c., St. Helens.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 3424

The Director-General, India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—

SCHEDULE 1.—462 STEEL TYRES for LOCOMOTIVES.

SCHEDULE 2.—150 CRANK and STRAIGHT AXLES for LOCOMOTIVES.

SCHEDULE 3.—300 AXLES for CARRIAGES and WAGONS.

SCHEDULE 4.—PISTON and CONNECTING-RODS, &c., for LOCOMOTIVES.

Tenders due as follows :—

Schedules 1, 2 and 3, 22nd October, 1929.
Schedule 4, 25th October, 1929.

Forms of Tender available from the above at a fee (which will not be returned) of 5s. for each schedule. 3460

Crown Agents for the COLONIES.

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/1285.—ENGINEERING DRAUGHTSMAN REQUIRED by the GOVERNMENT of NIGERIA for service in the Harbour Department for two tours, each of 12 to 18 months' service, and possible extension. Salary £510, rising to £600 a year by annual increments. Free quarters and passages and liberal leave on full salary. Candidates, age 25 to 35, must be experienced in the design of reinforced concrete wharves and other structures.

M/1758.—ASSISTANT ENGINEERS (2) REQUIRED for the KENYA and UGANDA RAILWAY and HARBOURS for a tour of 20 to 30 months' service and possible extension. Salary £480, rising to £720 a year by annual increments. Free quarters and passages and liberal leave on full salary. Candidates, 22-28 years of age, unmarried, must have passed Sections A and B of the examinations to qualify for Associate Membership of the Institution of Civil Engineers, or hold professional qualifications recognised by the Institution as exempting from those examinations. Should have had some experience on railway civil engineering work, but applications from Junior Engineers who have served pupilage and had subsequent experience with consulting engineers or on some large construction other than railways will be considered.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 3459

APPOINTMENTS BOARD OF THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

Including
ROYAL COLLEGE OF SCIENCE,
ROYAL SCHOOL OF MINES,
THE CITY AND GUILDS (ENGINEERING) COLLEGE,
SOUTH KENSINGTON, S.W. 7.

EMPLOYERS REQUIRING MEN who have received a thorough training in the principles of Engineering and who have obtained the Diploma of the City and Guilds (Engineering) College are asked to make use of the services of the Board. Applications should be addressed to the SECRETARY; no fees are charged.

These men have received instruction (including practical work in the extensive and well-equipped laboratories of the College) in Civil, Mechanical and Electrical Engineering, including Mathematics, Physics and Chemistry. Their training has been such that they are capable of specialising in any branch of Engineering that may be offered. 3415

Department of Scientific and INDUSTRIAL RESEARCH.

JUNIOR ASSISTANTS are REQUIRED at the NATIONAL PHYSICAL LABORATORY. Candidates must have a good Honours Degree or equivalent qualification in Engineering or Naval Architecture, and preferably some research or technical experience. Scale of salary £175-15-£235 per annum plus Civil Service bonus, the total pay corresponding to £175 basic is at present approximately £266. Superannuation provision will be made under the Federated Superannuation System for Universities.—Application must be made on a form to be obtained from the DIRECTOR, National Physical Laboratory, Teddington, to whom it should be returned not later than October 19th, 1929. 3378

Manchester Corporation. TO BRIDGE CONTRACTORS.

The Town Planning Committee invite TENDERS for the CONSTRUCTION of a BRIDGE to carry Princess-road Extension over the River Mersey, West Didsbury, and WORKS contingent thereto.

Plans may be seen and specification, bill of quantities, and form of Tender obtained on application at the City Engineer's Office, Town Hall, Manchester, on payment to the City Treasurer of £5 5s., which sum will, after the Corporation have come to a decision upon the Tenders received, but not before, be returned to the person submitting a bona fide Tender.

All cheques or postal orders are to be made payable to the order of "The Corporation of Manchester."

Tenders, enclosed in the official envelope and addressed to the Chairman of the Town Planning Committee, are to be delivered at the City Engineer's office not later than 9.30 a.m. on Tuesday, the 29th day of October, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

F. E. WARBRECK HOWELL, Town Clerk.

Town Hall, Manchester,
4th October, 1929. 3405

The Engineer

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PUBLIC NOTICES

Parish of Stepney. INSTALLATION OF CENTRAL HEATING SYSTEM.

The Guardians of the Poor of the Parish of Stepney invite TENDERS for the EXECUTION of WORK in connection with the installation of a complete Central Heating System at their Bromley House Institution, St. Leonard's-street, Bromley-by-Bow, E. 3.

Specification and bill of quantities may be obtained at my office on payment of a deposit of £1 1s. (cheques to be made payable to the "Treasurer, Stepney Guardians"), which will be returned on receipt of a bona fide Tender. The detailed drawings may be inspected on application at my office or at the office of the Consulting Engineers.

Tenders must be delivered to me in the envelope provided, marked "Central Heating, Bromley House," and must reach this office by not later than Twelve Noon on Thursday, 24th October, 1929.

Consulting Engineers, Messrs. Dolby and Williamson, 8, Princes-street, Westminster, S.W. 1.

By Order,
S. McCLELLAND,
Clerk to the Guardians.

Administrative Offices :
Bancroft-road, Mile End, E. 1,
4th October, 1929. 3420

South Indian Railway Com- PANY, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of—

1. INDIA RUBBER PADS and CUSHIONS.
2. SHEET and PLATE GLASS.
3. SCREWS and NAILS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for India Rubber Pads and Cushions," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 25th October, 1929.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 5s. for each copy of each specification.

Copies of drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 9, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France,
Westminster, S.W. 1.
9th October, 1929. 3458

PUBLIC NOTICES

Parish of Ipswich. HEATING AND HOT WATER SUPPLY INSTALLATION FOR THE INFIRMARY EXTENSION AT THE IPSWICH POOR LAW INSTITUTION.

The Guardians of the Poor of the Parish of Ipswich invite TENDERS for a CENTRAL HEATING and HOT WATER SUPPLY INSTALLATION, to be provided in the new Infirmary building about to be erected at Heathfields, in accordance with the plans and specification prepared by the Guardians' Consulting Engineer, George W. Martin, M.I. Mech. E., of 33, Arran-road, Catford, London, S.E. 6.

Plans and specification can be seen either at the Guardians' offices or the Consulting Engineer's office, and copies may be obtained on payment of a fee of One Guinea, which will be returnable on receipt of a bona fide Tender which is not subsequently withdrawn.

The contractor will be required to pay such rates of wages as are recognised by the trades unions concerned, or are generally accepted as fair in the respective trades.

The Guardians do not bind themselves to accept the lowest or any Tender.

Tenders, endorsed "Heating Installation, Heathfields," must reach the undersigned not later than Wednesday, October 30th.

By Order of the Board,
L. W. GREENHALGH,
Clerk to the Guardians.

Guardians' Offices,
19, Tower-street, Ipswich,
9th October, 1929. 3450

The Bengal and North-Western RAILWAY COMPANY, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

22 LOCOMOTIVE ENGINES and TENDERS, as per specification to be seen at the Company's offices.

Tenders, addressed to the undersigned and marked "Tender for Locomotives," with name of firm tendering, to be lodged not later than Noon on Tuesday, the 29th day of October, 1929.

For each specification a fee of £2 will be charged, which cannot under any circumstances be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
W. R. IZAT,
Managing Director.

237, Gresham House, Old Broad-street,
London, E.C. 2, October 8th, 1929. 3455

PUBLIC NOTICES

Essex County Council. BLACK NOTLEY SANATORIUM.

APPLICATIONS are INVITED for the APPOINTMENT of RESIDENT ENGINEER at the above Sanatorium. Salary £200 per annum, with unfurnished house, light and water.

Full particulars of the engineering plant and list of duties may be obtained from the undersigned.

Applications, stating age, qualifications and experience, accompanied by copies of not more than three recent testimonials (which will not be returned), should be addressed to me not later than Saturday, the 26th October, 1929.

JOHN H. GOOLD,
Clerk of the County Council.

Shire Hall, Chelmsford,
8th October, 1929. 3454

Indian State Railways.

THREE ASSISTANT ENGINEERS are REQUIRED for service in the Mechanical Engineering Department of the Indian State Railways.

AGE.—Between 25 and 30 years.

QUALIFICATIONS.—Candidates should have received a good general and technical education, and have passed the Associate Membership Examination of the Institution of Civil Engineers, or hold a Degree or Diploma granting exemption from Sections "A" and "B" of that Examination; should have served at least 4 years as pupil or apprentice in the Locomotive Workshops of a British Railway Company or firm of Locomotive Builders of repute, and at least 1 year in the drawing-office. They should possess an intimate knowledge of the planning, progressing and costing methods adopted in workshops of up-to-date commercial firms.

SALARY.—The initial salary will be from Rs. 375 plus Rs. 150 overseas allowance to Rs. 625 plus £15 overseas allowance according to the age, qualifications and experience of the candidate. Overseas pay is admissible only to officers of non-Asiatic domicile. Salary payable from date of landing in India, subject to rules in force.

Leave, Provident Fund and gratuity in accordance with the rules applicable to officers of the Indian State Railways. Agreement for 3 years in the first instance, but service to be extensible beyond that period with the consent of both parties concerned.

A first-class passage to India will be provided on appointment.

Application must be made by letter only, and all applicants must state their age, whether married or single, and give full particulars (in chronological order) of their education, training and subsequent experience, stating the names of railways or contractors by whom they have been employed, and giving details of the work employed upon, with dates. Details should also be given of any previous experience abroad, together with copy of leaving certificate.

Applications, which should be accompanied by copies only of testimonials, must be addressed to the undersigned not later than 31st October, 1929.

Messrs. RENDEL, PALMER and TRITTON,
12/15, Dartmouth-street, Westminster, S.W. 1. 3412

NOTICE.

Wanted—An Assistant Elec- TRICAL ENGINEER for the Ganges Canal Hydro-electric Scheme in the Public Works Department, Irrigation Branch, of the United Provinces, India, to Supervise the Design, Installation and Operation of Extra High-tension Switch and Protective Gear of the most modern type, and to exercise general control over the operation of a widespread scheme of supply, including the Maintenance Work of Turbine Stations and of Transmission Lines. The headquarters of the post will be at Roorkee.

Applicants must have had at least five years' experience in the design, manufacture and operation of modern high-tension oil switchgear and protective apparatus with approved firms, and must furnish testimonials from such firms showing their capacity to install and operate such equipment. They must not be less than 30 years or more than 42 years of age. The appointment will be for one year in the first instance and may be extended to five years. The applicant appointed, if recruited in a country outside India, will be granted a first-class passage to enable him to join his appointment, and a first return passage if his services are dispensed with on termination of his agreement after one year. If his agreement is extended or he is made permanent, the right to a return passage will be forfeited. The pay will depend on age and will be on an incremental scale, rising from Rs. 725 p.m. in the 30th year of age by increments at prescribed intervals to Rs. 1375 p.m. in the 46th year of age and upwards; sterling overseas pay at £25 to £30 p.m. according to age will be granted in addition if the officer appointed is of non-Asiatic domicile. A conveyance allowance of Rs. 125 p.m. plus 2 annas a mile for journeys over twenty miles a day will be granted subject to the condition that the officer maintains and uses a motor car for all road journeys on duty. The officer will be required to subscribe monthly one-twelfth of his pay to the General Provident Fund and Government will add half-yearly a bonus of 100 per cent. of his subscriptions. Leave will be granted in accordance with the Government rules applicable to specialist officers.

Applications must be posted by air mail (copies to be sent by ordinary mail) to reach the undersigned by November 12th, 1929, at latest, and the applicant selected must join his appointment by December 31st, 1929, at latest.

(Sd.) W. L. STAMPE,
Chief Engineer and Joint Secretary to Government, U.P. Public Works Department, I.B.

Camp Roorkee, U.P. 3418

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PUBLIC NOTICES

Municipality of Singapore,
STRAITS SETTLEMENTS.
WATER DEPARTMENT.
ASSISTANT WATER ENGINEER.

The Municipal Commissioners of Singapore REQUIRE an ASSISTANT ENGINEER for the permanent staff of their Water Department, the appointment being in the first instance on a three years' agreement.

Candidates should be between 21 and 25 years of age and unmarried. Applicants should possess a recognised University Degree in Civil Engineering or have passed Sections A and B of the Associate Membership Examination of the Institution of Civil Engineers. They must have served articles or gained experience under a qualified engineer, though not necessarily one engaged in waterworks practice.

Strict medical examination.

Salary, $280 dollars, $760 dollars and $240 dollars per annum respectively for the three years of the agreement, and rising thereafter (if service be continued) to a maximum of $600 dollars per annum. The exchange value of the dollar is 2s. 4d. sterling, at which rate the salary for the first year would amount to £616. There is at present no income tax.

Free first-class passage will be provided with half salary during the voyage out.

An allowance for transport on duty will be granted.

Eight months' leave with full pay is normally granted after four years' service. Liberal Provident Fund.

Applications, stating whether married or single and giving age and birthplace, with details of education, training and experience, and referring particularly to the qualifications mentioned above, and accompanied by copies (not originals) of testimonials, to be lodged with Messrs. PEIRCE and WILLIAMS, MM. Inst. C.E., 64, Victoria-street, London, S.W. 1, Agents to the Commissioners, not later than Monday, 21st October, 1929.

Further particulars, if desired, can be obtained from the Agents. 3407

Municipality of Singapore,
STRAITS SETTLEMENTS.
ELECTRICITY DEPARTMENT.
BOILER-HOUSE CHARGE ENGINEER.

The Municipal Commissioners of Singapore REQUIRE a BOILER-HOUSE CHARGE ENGINEER, age not exceeding 35 years, for service at their Electric Power Station, the appointment being on the permanent staff of their Electricity Department and being in the first instance upon a three years' agreement.

The capacity of the plant is over 20,000 kilowatts. Candidates must have had a thorough experience in the operation and maintenance of Boilers and Boiler-house Instruments. They must be thoroughly acquainted with Babcock and Wilcox balanced draught system and chain-grate stokers, also Babcock and Wilcox pressure system of oil firing. Knowledge of E.H.T. 3-phase generation and steam turbines is desirable. Candidates must have held a similar position for at least two years and must possess at least a Second Engineer's B.O.T. Steam Ticket.

Strict medical examination required.

Salary, 5040 dollars, 5520 dollars and 6000 dollars per annum respectively for the three years of the agreement and rising thereafter (if service be continued) to a maximum of 8400 dollars per annum. The exchange value of the dollar is 2s. 4d. sterling, at which rate the salary for the first year would amount to £588. There is at present no income tax. Free partially furnished quarters provided, with an allowance for lighting.

Free passage will be provided with half salary during voyage out. Eight months' leave with full pay is normally granted after four years' service. Liberal Provident Fund.

Applications, stating whether married or single and giving age and birthplace, with details of education, training and experience and referring particularly to the qualifications mentioned above, and accompanied by copies (not originals) of testimonials, to be lodged with Messrs. PEIRCE and WILLIAMS, MM. Inst. C.E., 64, Victoria-street, London, S.W. 1, Agents to the Commissioners, not later than Monday, 21st October, 1929.

Further particulars, if desired, can be obtained from the Agents. 3408

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ASSISTANT RESIDENT ENGINEER for Traction Power Station, London district, equipped with large Turbo-generators and modern Boiler units. Applicants must possess sound practical and technical knowledge of all problems relating to Power Generation, and be fully competent to Take Full Charge of Operation and Maintenance. Strong personality and ability to control staff is essential. Excellent prospects for a capable man. Commencing salary £500.—Write, Box "G. W. J.," c.o. Davies and Co., 95, Bishopsgate, London, E.C. 2. 3345 A

WANTED, FOUNDRY SUPERINTENDENT, capable of managing foundry producing 80 tons large and small castings in iron per week. Experienced in working in loam and greensand, latest labour-saving devices in foundry, controlling men on piece-work basis. Preference to man with patternshop experience and training.—Address, stating age, experience, and salary required, 3425, The Engineer Office. 3425 A

ALL-ROUND ENGINEER REQUIRED Within 14 days for permanent appointment in London; skilled in Electrical Work and with good knowledge of Railway Track and Civil Engineering. Satisfactory references for capability and character essential. Also VACANCY as ASSISTANT to above.—Reply, with references and salary required, to Box 610, at Horncastles, 60, Cheapside, E.C. 2. P6290 A

ALLOYED TOOL STEELS.—First-class SALESMAN REQUIRED for Birmingham area. Thorough knowledge of the trade essential. Applicants are requested to send fullest particulars of their qualifications. Important post for suitable man.—Address, P6264, The Engineer Office. P6264 A

COST ACCOUNTANT REQUIRED by Large Engineering Works in the Midlands.—Address, stating age, experience, references, salary required, 3421, The Engineer Office. 3421 A

DEMONSTRATOR RATE-FIXER.—First-class MAN REQUIRED for Machine Shop. Preference with Pollock and McNab and Herbert No. 9 experience. Full particulars and wages required.—Address, 3406, The Engineer Office. 3406 A

D. NAPIER AND SON, LTD.,
LONDON,
the AERO ENGINE MANUFACTURERS,
INVITE APPLICATIONS for the POSITION of WORKS MANAGER.

Replies will only be considered from men of ability having previously held a like position, used to controlling large numbers of skilled engineers and experienced in the highest class of engineering. Applications, which will be treated in the strictest confidence, should give the fullest details of past experience, as well as age and remuneration required, and should be addressed to—

(Box 1220),
D. NAPIER AND SON, LTD.,
Acton, London, W. 3,

Marked "Confidential." 3349 A

ENGINEER REQUIRED for the Preparation and Submission of Tenders for Oil Engines and Oil Engine-driven Generating Sets. Must have had similar experience. State qualifications and salary expected.—Address, 3410, The Engineer Office. 3410 A

ESTIMATOR WANTED for London Office of Conveyor and Structural Engineers. State experience and salary required.—Address, 3403, The Engineer Office. 3403 A

GENERAL and WORKS MANAGER for Engineering Works and Foundry in Midlands employing 250 to 300 hands. Applicants must have up-to-date knowledge of Modern Machine Shop and Foundry Practice, with good commercial experience. State age, particulars of training and experience, with salary required.—Address, P6279, The Engineer Office. P6279 A

MECH. ENGINEER, Public School, Age 40, URGENTLY REQUIRES POST. Thorough experience of works management and commercial side of engineering. Accept position in works or sales engineer. London area preferred.—Write, Box F. 48, Willings, 85, Strand, W.C.2. 3442 A

SALES MANAGER REQUIRED for Rapidly Developing Business making Marine, Railway and other kinds of Packings. Must be experienced in this class of work, young and energetic. Lucrative opening for right man.—Address, 3417, The Engineer Office. 3417 A

SENIOR TESTERS REQUIRED by Lancashire firm of Engineers, for Instruments and Meters; must have had wide experience and possess ability to control men.—Address, with particulars of age, training, experience and salary required, 3381, The Engineer Office. 3381 A

TECHNICAL ENGINEER REQUIRED, Fully qualified to handle correspondence and specifications in connection with Induced and Forced Draught Plants to Boilers, Kilns, Furnaces, &c., also Mine Ventilation. Preference given to one having had experience in Constructional Details of Modern Fans of large size. Excellent prospects.—Write, stating fully practical engineering experience and special qualifications, age, salary required, &c., to 3461, The Engineer Office. 3461 A

TECHNICAL EXPERT REQUIRED by Company engaged in Cold-laid Mastic Asphalt Trade; must be fully experienced and qualified to advise on the composition and application of all materials concerned. Reply fully, stating experience, &c. SALESMEN with suitable experience also REQUIRED.—Address, P6293, The Engineer Office. P6293 A

TRAVELLER REQUIRED for London Office of Midland firm supplying all kinds of Steel Plate and Structural Work. State remuneration required.—Address, 3272, The Engineer Office. 3272 A

WORKS MANAGER REQUIRED IMMEDIATELY, to take control of 200-hand factory in South of England. Must have had experience in quantity production of Wood and Metal Parts. Must be first-class organiser, firm disciplinarian, used to modern up-to-date factory methods. A good practical knowledge of Petrol Engines and their general installation essential. This is a progressive position and a fine opportunity for an energetic man. Replies should state full experience, salary required, age, and photograph, if possible.—Address, 3277, The Engineer Office. 3277 A

WANTED, Capable DESIGNER of Modern Overhead Electric Travelling Cranes. Should have first-class theoretical training and extensive practical experience. Age not under 35. State age, experience and salary required.—Address, 3453, The Engineer Office. 3453 A

WANTED, DRAUGHTSMAN, with Experience of Mechanical Equipment of Electric Winders. State particulars of age, experience, and salary.—Address, 3279, The Engineer Office. 3279 A

WANTED IMMEDIATELY, DRAUGHTSMEN for Detail Work on Machine Tools.—Address, stating age, experience, and salary required, 3429, The Engineer Office. 3429 A

WANTED, MACHINE TOOL DRAUGHTSMAN, Midlands. State full experience, age, and salary required.—Address, 3452, The Engineer Office. 3452 A

WANTED, TWO Good DRAUGHTSMEN, Accustomed to High-speed Turbines and Centrifugal Pumps. High-grade technical training essential.—Address, 3427, The Engineer Office. 3427 A

CONSTRUCTIONAL DRAUGHTSMAN WANTED in Lancashire Office. Must be a good and reliable draughtsman, experienced in Steel and Reinforced Concrete Constructional Work. State training and class of work accustomed to, age and salary required. Enclose copy of recent testimonial.—Address full particulars, 3416, The Engineer Office. 3416 A

DETAILING MECHANICAL DRAUGHTSMAN REQUIRED, experienced in Gas Compressors. Salary £4 10s. per week. London area.—Address, stating age and previous experience, 3443, The Engineer Office. 3443 A

DRAUGHTSMAN and MACHINE DESIGNER, One with initiative and inventive ability; must be first-class, with preferably a University Engineering Degree. State salary required and age.—Address, 3369, The Engineer Office. 3369 A

DRAUGHTSMAN REQUIRED by Midland Constructional Steel Firm. Must be fully trained and with experience in Colliery Screen Work.—Address, P6286, The Engineer Office. P6286 A

DRAUGHTSMAN REQUIRED for Industrial Instrument Design, London. State age, experience, and salary required.—Address, 3437, The Engineer Office. 3437 A

DRAUGHTSMAN REQUIRED for North London, experienced in Refrigeration and with knowledge of Dairy Plants, including Lay-outs.—Write age and full particulars to 3462, The Engineer Office. 3462 A

DRAUGHTSMEN REQUIRED, Preferably Accustomed to Small Electrical Apparatus and Lay-outs. Must be speedy and accurate workers.—Address, stating age, experience, and salary required, 3451, The Engineer Office. 3451 A

DRAUGHTSMEN REQUIRED, Senior and Junior, for Aeronautical Design.—Write, giving particulars of past employment, age, experience, and salary required, to Box 130, Advertising Offices, 84, Queen Victoria-street, London, E.C. 4. 3355 A

DRAUGHTSMAN REQUIRED, with Experience in Hydraulic and Structural or Mechanical Work. Permanent and good prospects for keen man.—Address, stating age, experience, and salary required, 3432, The Engineer Office. 3432 A

DRAUGHTSMAN REQUIRED, with Experience of Small Mechanical Apparatus, Jigs, Fixtures and Gearing. State age and qualifications.—AUTO ELECTRIC DEVICES, Ltd., Diamond Works, Brighton. 3419 A

DRAUGHTSMAN WANTED, Used to General Milling Engineering.—Address, stating experience and salary required, 3430, The Engineer Office. 3430 A

DRAWING-OFFICE.—Opportunity for Intelligent LAD between 14-16 years, with technical education. Job offers prospects.—Address, stating particulars of training, 3441, The Engineer Office. 3441 A

EXPERIENCED DRAUGHTSMAN REQUIRED for Designing Office. Applicants must be conversant with the design of all types of Steam and Electric Cranes.—State age, experience, and salary required to COWANS, SHELDON and CO., Ltd., Carlisle. 3404 A

EXPERIENCED DESIGNING ENGINEER REQUIRED by Electrical Manufacturing Company. Must have wide experience of Large Alternating-current Generators. State age, experience, and salary required.—Address, 3435, The Engineer Office. 3435 A

FIRST-CLASS JIG and TOOL DRAUGHTSMAN REQUIRED for Motor Car Works in the Midlands. Experience in processing and estimating on large output basis. Only first-class men need apply. State age, full particulars of experience, and salary required.—Address, 3411, The Engineer Office. 3411 A

INDIA.—REQUIRED by British Firm of Engineers, DRAUGHTSMAN, accustomed to Roof, Bridge and Structural Steel Work, able to work out stresses and prepare designs, estimates and detail drawings. Must be a bachelor, age 22 to 27.—Apply, stating age and particulars of experience, to Z.R. 290, care Deacon's Advertising Agency, Fenchurch-avenue, London, E.C. 3. 3449 A

JUNIOR DRAUGHTSMAN REQUIRED in Stamford, Lincolnshire, temporarily, for making drawings from machined parts.—Apply by letter to K.L.P.R., Ltd., 555, Abbey House, Westminster, S.W. 1. 3426 A

JUNIOR DRAUGHTSMAN, Used to Sheet Metal Work, Ventilating Air Duct, Tank Work, taking own details on job. S.E. London.—Write, stating experience, salary, in confidence, to Box 340, Sells Advertising Offices, Fleet-street, E.C. 4. 3446 A

STRUCTURAL DRAUGHTSMAN WANTED by a Firm of Calcutta Structural Engineers; required for light and heavy work. Must have knowledge Estimating. Unmarried. Age about 25. Salary commencing Rs. 500 per month; 5 years' agreement.—Apply in writing, with full details of experience, to ALEX. LAWRIE and CO., Ltd., 14, St. Mary Axe, E.C. 3. 3444 A

STRUCTURAL ENGINEERING DRAUGHTSMAN WANTED AT ONCE for Southampton, accustomed design and estimating. State age, experience, and salary required.—Address, P6094, The Engineer Office. P6094 A

STRUCTURAL STEEL WORK.—SENIOR DRAUGHTSMEN REQUIRED IMMEDIATELY in London Office, accustomed Large Theatre Work. Experience, salary required, and date could commence.—Address, 3423, The Engineer Office. 3423 A

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For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Aircraft Inspection by Lloyd's.

It was announced in July last that the Air Ministry had authorised the British Aviation Insurance Group to undertake the inspection of civil aircraft for the renewal of Certificates of Airworthiness, the authority being limited for the time being to the inspection of privately owned and club aircraft. We understand that arrangements have now been made, with the approval of the Air Ministry, whereby this duty is transferred from the British Aviation Insurance Group to the Committee of Lloyd's Register of Shipping. The Committee has appointed Mr. L. J. Hill, until recently stationed at Croydon Aerodrome, in charge of the inspection of civil aircraft on behalf of the Air Ministry, to be the Society's Surveyor for Aircraft. Mr. Hill has already entered upon his duties, and his services are now at the disposal of owners of aircraft and of underwriters and others who may desire to avail themselves of his knowledge and experience. The procedure will be similar to that at present in force. The owners of the aircraft concerned will make the usual application to the Air Ministry for the renewal of the certificate of airworthiness, but they can have the inspection carried out by Lloyd's Register of Shipping, whose Surveyor is authorised by the Air Ministry to issue a provisional certificate immediately after the aircraft is found to be satisfactory—pending the endorsement by the Ministry of the original certificate for a further period. The new department of Lloyd's Register will also be available for the inspection of damaged aircraft to determine the actual condition and the nature and extent of the necessary repairs. It is expected that in time the Aviation Department will embrace many of the services which Lloyd's Register renders in the sphere of shipping. Steps have therefore been taken with a view to the formation of a special Aviation Committee which shall include some of the principal representatives of underwriters, British aircraft constructors, owners of aircraft, and members of bodies interested in aviation.

Electric Lighting.

A campaign which is of more than trade interest has been started by the Electric Lamp Makers' Association with the object of drawing attention to the danger to eyesight and to other drawbacks arising from the use of unshaded electric lights. At a recent luncheon given by the North-Western Committee of the British Electrical Development Association in the Midland Hotel, Manchester, Mr. C. A. Hughes, of the British Lamp Makers' Association, explained that the early frosting of bulbs had not been altogether satisfactory, for it made the surface rough, and it had a tendency to pick up dust, so that in the course of time a considerable amount of light was lost. Within recent times, however, a cheap and efficient glareless lamp had been produced. The lamp had two bulbs, a skin of opal glass with a clear bulb outside. The amount of absorption with these lamps was almost negligible, and they got rid of harsh shadows. Propaganda is also being carried on in London with the object of increasing the use of these glareless lamps. In Savoy-street the Lamp Makers' Association has an interesting lighting service bureau, with a laboratory for testing and demonstrating the latest lighting methods, and at a recent gathering in the laboratory, experts in electric lighting and optical science explained the new movement. To a large extent the change had been forced upon the industry by the efficiency of the present-day gas-filled lamp, with its extremely brilliant filament, which cannot be gazed upon without a good deal of strain to the eyes. Incidentally, the Lighting Service Bureau is open to anyone who wishes to obtain information about the latest house lighting and street lighting schemes.

New Greek Destroyers.

Those who took part in the recent Summer Meeting of the Institution of Naval Architects in Italy, and who saw the remarkable activity in the well-equipped shipyards of that country, will not be surprised by the news that the Genoa firm of N. Odero and Co. has been successful in securing the order for two destroyer leaders for the Greek Government, at a price much below that of other competitors. The price of the ships is given as £255,000 each, if the four Dardo type 12 cm. guns are placed singly, or £246,000 if they are placed in pairs as in the Italian destroyers. The tenders included offers from six British firms, three French yards, and three Italian yards, and it is understood that the British prices were on an average about £50,000 more than the tender which was accepted. The new vessels are to have a length of 92·35 m., or about 303ft., with a beam of 9·2 m., or a little over 30ft., and a draught of 3·31 m. or about 10ft. 10in. The displacement will be 1450 tons and the maximum speed 40 knots, with a trial speed over four hours of 39·5 knots, and an economic cruising speed of 20 knots. The propelling machinery will consist of three water-tube boilers and two Parsons type turbines, and the armament will include four 12 cm. guns, three 40 mm. anti-aircraft guns, and six 53 cm. torpedo tubes. The first ship is to be delivered in twenty months, and the second about two months after. The decision with regard to the placing of the guns referred to above will be made in about ten days. The Minister of Marine in Athens states that these vessels are required to complete the renewal of that country's small navy, and that they will embody the latest developments in destroyer design.

Gas Engineers at Middlesbrough.

Middlesbrough, the first borough to adopt the system of utilising coke oven gas for illumination and general domestic purposes, was recently the scene of the Autumn Conference of the North of England Gas Managers' Association, the President of which is Mr. F. Blincoe, the Middlesbrough gas manager. About 500 delegates were welcomed in the Council Chamber by the Mayor, Councillor George Alexander, who recalled that it was some forty-five years since the Gas Managers' Association last visited Middlesbrough. In his presidential address Mr. Blincoe said that he was proud to be associated with an undertaking which still had the largest plant for the supply of coke oven gas, and which distributed the cheapest gas in the country. The price of gas to ordinary consumers was 1s. 10d. per 1000 cubic feet, which was equal to 4d. per therm. The consumption had grown from 515,000,000 cubic feet in the financial year ending March 31st, 1926, to 1,042,000,000 cubic feet for the year ending March 31st, 1929. Following the meeting visits were paid to the local gasworks and to the Newport Ironworks of Dorman, Long and Co., Ltd.

The Retirement of Dr. Stodola.

On the occasion of his seventieth birthday, Professor Dr. Aurel Stodola, of the Federal Technical University of Zürich, relinquished his post as lecturer, and will be succeeded by two of his former pupils. Dr. G. Eichelberg, formerly the head of the research department of Sulzer Brothers at Winterthur, has been appointed as lecturer in thermodynamics and internal combustion engines, and Mr. Quiby, who formerly was the chief turbine engineer of Escher-Wyss, will lecture on steam turbines, turbo-compressors, and steam machinery. Dr. Stodola was born in a small Hungarian town in 1859, and after studying at Budapest and Zürich, entered the Zürich University in 1878, and received his diploma in 1881 with distinction. After serving for some time on the Budapest railway works, he went to Berlin to attend the lectures of Helmholz. In 1884 he spent some time in Paris, after which he went to Prague as the chief engineer of Ruston and Co. In 1892, however, he returned to his old university at Zürich as Professor of Mechanical Engineering, a position which he has continued to hold with the highest distinction over a period of thirty-seven years. He was a teacher of remarkable gifts, with a clearness of expression which at the same time compelled his hearers to exercise their own intellects and to recognise mechanical and physical inter-relations. Under his guidance difficult problems were easily solved. Dr. Stodola is perhaps best known by his book on turbine design, which has passed through six editions, and is available in English. His work was further characterised by the wide use of Mollier's entropy chart, which was extended in 1928 by the entropy chart for gases based on the kilogramme molecule unit. The wide range of his own work is reflected in a festival volume of essays by his friends and pupils, which was published in Zürich this year. We would express the hope that in his retirement Dr. Stodola may find time to attack new problems, and to add still further to the great services which he has rendered to international engineering science.

A New Electricity Supply.

The electricity supply for Whaley Bridge, Chapel-en-le-Frith, Chinley, and District was switched on a few days ago by Mr. W. H. Flanagan, a well-known Manchester resident. The scheme has involved the provision of 30 miles of high-tension cable and about 9 miles of low-tension cable, and is said to have cost the Trent Valley and High Peak Electricity Supply Company £40,000. At present there are only 150 consumers, and the number will have to be considerably increased before the scheme can pay.

A New Bridge Over the Nile.

A new combined railway and road bridge over the river Nile at Jinja, Lake Victoria, is to be constructed to carry the Kenya and Uganda Railway over the Nile and to permit its extension to Kampala, some 50 miles distant. At the same time the new bridge will obviate the necessity for the present ferries, and will open up for development the Kampala district. The designs for the new bridge have been prepared by Messrs. Rendel, Palmer and Tritton, of Westminster, and the order for the steel work has been placed by the Crown Agents for the Colonies with P. and W. MacLellan, Ltd., of Clutha Works, Glasgow. The main span of the bridge will be of the two-hinge arch type, with a length of 260ft. The railway will be carried on a top deck over the arch, with a roadway and two footpaths suspended from the arch at a distance of 34ft. below the top deck. The steel work is to be built up in sections and erected on its own bearings in the builder's yard, after which it will be dismantled and shipped to East Africa for re-erection on the site. The estimated cost of the new bridge is stated to be about £80,000.

Stabilised Wages in the Shipbuilding Industry.

On Tuesday of this week, October 8th, representatives of the trades unions employed in the shipbuilding yards of Great Britain and Northern Ireland met in London to consider the wages advance offered by the Shipbuilding Employers' Federation. This advance took the form of an offer to establish a uniform national time rate of £3 weekly for skilled plain time workers, and of 41s. for unskilled workers. The offer was made in reply to the unions' demand for an all-round increase of 5s. per week in the wages paid to time workers. At Tuesday's meeting the unions decided by vote to accept the employers' offer. The new arrangement will apply only to time workers and not to those employed on piecework. It will involve advances ranging from 1s. to 5s. per week. The standard wages will be paid as from the beginning of next January. All advances up to 2s. weekly will be made in that month, and balances beyond that amount will be paid three months later. It is anticipated that the new arrangement will bring considerable advantage to the industry. It should enable innumerable sectional claims to be avoided, and permit employers to estimate their costs on a stable wage basis. The arrangement is not applicable to members of the Boilermakers' Society or to those of the Amalgamated Society of Woodworkers. If, however, the second named society succeeds in settling the Belfast shipyard joiners' strike, which has now lasted six months, application may be made by it for including its members in the stabilised wages scheme.

Harland and Wolff, Ltd.

An interesting report has just been issued by the directors of Harland and Wolff, Ltd., covering the half year ended on June 30th last. The financial results for the period under review are an improvement on the corresponding period of the previous year. The tonnages launched at the Belfast and Glasgow yards since the year 1925 are as follows:—1926, 88,633 tons; 1927, 94,700 tons; 1928, 101,786 tons; and 1929, up to September 30th, 101,760 tons. At Belfast twenty vessels are on the slipways, or are being fitted out, and three vessels will follow as soon as berths are vacant for them. Seven vessels are on the slips, or are being fitted out at Glasgow. The repairing yards at Southampton, London and Liverpool are well employed, as are also the foundries. It is pointed out that nearly one-third of the tonnage in hand is for new clients and companies not connected with Lord Kylsant's shipping interests, while new orders for oil engines have been recently received. Although the joiners' strike still continues at Belfast, there are approximately 25,000 men employed in the firm's shipyards, engine works and repair works, and at present about £75,000 is paid per week in wages alone. During the last few days the firm has been fortunate in securing an order from continental owners for six first-class cargo liners of 10,000 tons each, which, it is understood, will be equipped with steam-propelling machinery.

Pylons on the South Downs.

The Ministry of Transport on Wednesday evening officially announced that after carefully considering the report of the inquiry held on September 11th and subsequent days into the application made by the Central Electricity Board for consent to the erection of an overhead transmission line from Brighton to Hastings, *vid* Eastbourne, the Minister had decided to give his consent to the erection of the line along the proposed route. The consent was, however, subject to further consideration being given to the position of the line and its supports to the immediate south-west and south-east of the village of Offham, near Lewes, and subject also to the reservation of power to review the situation any time after the expiry of five years.

The Use of Steel Pit Props.

About a week ago several thousand miners employed at the Linton Colliery of the Ashington Coal Company, Northumberland, threatened to come out on strike in order to enforce a demand that all the steel props should be withdrawn from the company's collieries on the ground that the lives of the miners were endangered by the use of such props. It was further held by the men that timber props gave a warning of a fall by cracking, whereas the steel props did not. As has since been ably pointed out by the British Colliery Owners' Research Association and such an eminent authority as Professor Henry Louis, there is no warrant for the holding of such views. On the contrary, wherever steel props have been used the reports of the Chief Inspector of Mines show that there has been a marked reduction in the number of accidents arising from falls of roof. The hope is expressed that the men may see fit to investigate the actual facts for themselves.

An Electrically-Operated Beet Sugar Factory.

No. II. (*conclusion*).*

After the second carbonation and subsequent filtration the treatment of the juice varies in accordance with the grade of sugar which it is desired to produce. The Allscott factory is equipped for the production of refined sugar, but during the last "Campaign" only raw sugar was produced, and as we gather that during the coming "Campaign" the same course is to be pursued, we shall continue to describe the processes as actually carried out. The juice, then known as "thin juice," as delivered from the filters after the second carbonation, contains as much as 86 per cent. of water. To reduce that percentage to such a point that crystallisation of the sugar may take place, the juice is first of all concentrated in a series of four evaporators, the original steam applied to which is the exhaust steam from the turbo-generators supplying power to operate the factory, to be described later on. These evaporators may be seen in the centre of the view shown in Fig. 7 *ante*. The exhaust from these evaporators is, as explained above, taken to the heaters, the exhaust from which again is further employed for other purposes. The discharge from the evaporators—known as "thick juice"—is once more filtered, this time under pressure, by the pumps seen in Fig. 11, and is then delivered to vacuum pans, of which there are two and in which the final concentration takes place under vacuum. These pans are of a special type, and it is claimed for them that they are the most efficient that have ever been introduced. The evaporate from them is condensed by means of barometric condensers in the roof of the building, the air and gases being removed by electrically driven rotary pumps, while the heated condensing water is used for feeding boilers and other purposes. There is thus a continuous circulation of the water in the system.

The discharge from the vacuum pans, which is known as "massecuite," or "fillmasse," is a mixture of crystals and syrup, and is of a brown colour. It is discharged into large tanks known as crystallisers, in which agitator plates are kept revolving, and there, in cooling, crystallisation continues, the small crystals already formed in the vacuum pans attracting further crystals to themselves and becoming larger. When crystals of the desired size have appeared the syrupy mass is fed into centrifugals, of which there are five—see Fig. 12—and when the latter are revolved at high speed by their motors the syrup is forced outwards through the sugar crystals, leaving the latter adhering to the sides of the basket. After a short spraying with water to remove the last traces of syrup, the completed sugar is removed from the basket by scraping.

The factory is equipped for making three grades of raw sugar, *i.e.*, "1st Sugar," "Middle Product," and "Low Product." By the process just described 1st Sugar is produced. The Middle Product is obtained by further boiling of the syrup and wash water from the first centrifugals in another vacuum pan, the discharge from which is into a further crystalliser. The syrup from this tank is dealt with in three further centrifugals, and the syrup and wash water from the latter are treated in two additional vacuum pans, which discharge into a series of five crystallisers, the syrup from which is delivered to a set of four centrifugals which produce "Low Product" sugar. The syrup from these centrifugals is known as molasses. It still contains a small percentage of sugar, but not in such quantity as to be economically extractable. It is therefore disposed of separately, some of

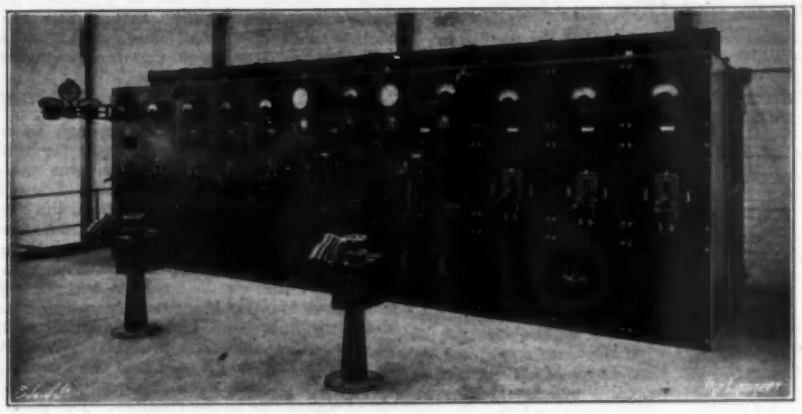


Fig. 10—Main Switchboard in Power House

Fig. 11—"Thick Juice" Pumps

Fig. 12—Battery of Centrifugals

Fig. 13—Piling Sacks of Sugar into Stacks

Fig. 14—Wet Pulp Conveyors

* No. I. appeared October 4th.

it being used to mingle with the dried pulp to form cattle food, as explained later. For its storage there is a circular steel tank arranged outside the buildings.

As has been said above, the factory is fully equipped for the production of refined sugar, though, as has been explained, refining is not at present being carried out. The additional apparatus and equipment required for it is, however, installed. Among the latter are vegetable charcoal agitators and filters and means for the manufacture and application of sulphur dioxide gas, both being used for bleaching purposes.

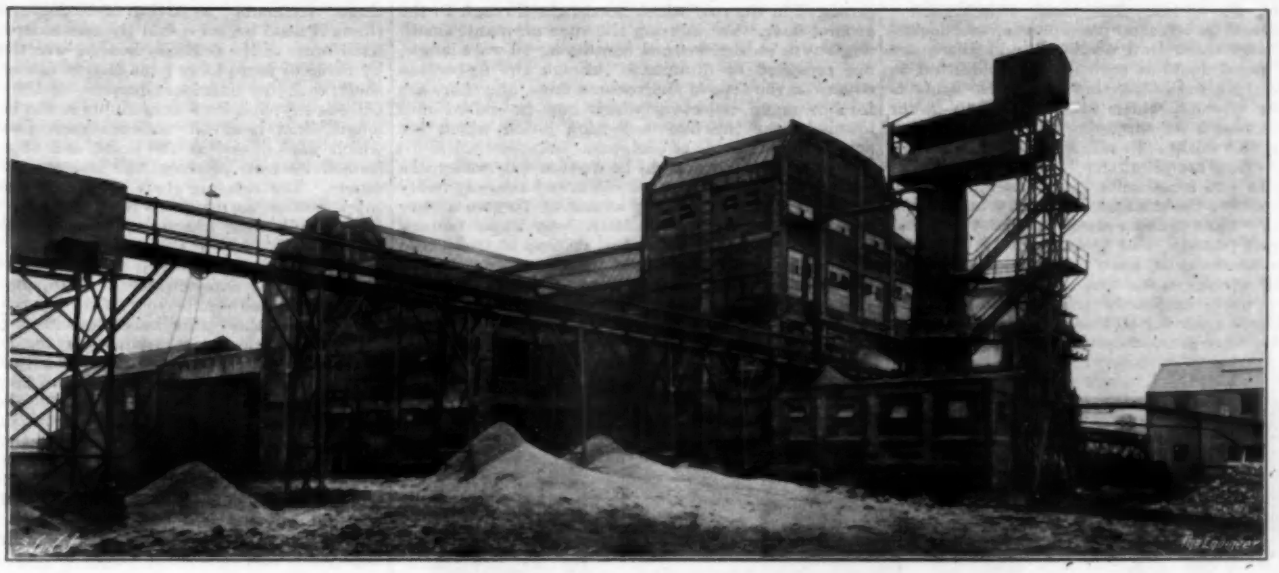


FIG. 15—EXTERIOR VIEW OF FACTORY SHOWING LIME KILN AND PIPE GANTRY

The sugar removed from the centrifugals is transported by a steel band conveyor into another building, where it is discharged into large zinc-lined bunkers, from which it is drawn as required through automatic weighing machines into sacks, the latter either being loaded direct into wagons or taken into store. A view of the sacks being stacked in the store by an electrically operated conveyor-elevator is shown in Fig. 13.

We can now return to various points regarding which further information was promised earlier in this article.

In order to provide the lime and the carbon dioxide gas which are required for the clarification processes described in the foregoing, a lime kiln, built on the Khern system, has been erected at one end of the building—see Fig. 15. It is furnished with a lift, made by the Express Lift Company, by means of which limestone and coke are raised to its charging platform. During the process of burning the limestone, CO_2 gas is evolved, and it is withdrawn by electrically driven rotary pumps, passed through a washing and purifying apparatus, and delivered to the carbonators as required. The quicklime produced is discharged at the bottom of the kiln and is introduced, with a supply of sweet water from the filter presses, as already explained, into a revolving drum, where it is slaked to form milk of lime. Any unbroken lumps are separated out from the liquid by means of a shaking screen which delivers them outside the building. After it has been passed through a sand separator the milk of lime is kept in motion by a circular agitator to prevent the hydroxide, which is not in actual solution, but only in suspension, from being deposited. From the agitator tank an electrically-driven plunger pump delivers the liquid as required into tanks, from which it is allowed to flow in the desired quantity into the tanks containing the raw juice from the diffusers, as explained earlier in this article.

Then, again, as to the disposal of the spent cossettes or wet pulp, when they or it are discharged from the diffusers. First of all, they are washed into a trough arranged at the end of the battery of cells, and from it they are forced by pump to near the top of the building. There, a sloping screw conveyor, which is driven by a 20 H.P. pipe-ventilated motor, scrapes the mass slowly up over perforated screens. At the top the pulp, which by this time has lost some of its moisture and is in a partially dried condition, is delivered to a further conveyor, which transports it to a battery of four Weigel drying presses in which more of its moisture is removed.

The water draining from these conveyors and presses, which naturally contains a certain amount of sugar, is freed from pulp as far as possible in a slice catcher—based on the May patents—Fig. 3 *ante*—which passes it over brass screens that are kept clear by a revolving system of brushes. In its cleared state it is available for re-use in the diffusion process.

The wet pulp is partly disposed of, without further treatment, for cattle food, and there is an arrangement by which it can be loaded direct into vans or lorries. The bulk of it, however, is completely dried in two special ovens or kilns. The latter, which are constructed on the "Buttner" system, and are very similar to the dryers that are used for coal before it is powdered for fuel, comprise rotating drums, through which pass the gases coming from a coal-fired furnace. The drums are furnished internally with specially shaped baffles, which tumble the pulp about and pass it along to the discharge end in the current of hot gases. In that way practically all the moisture is removed, and the "dry pulp" is blown along through a pipe leading to an adjoining building by a current of air. In the pulp store, the dried material may either be stacked in bulk, or, as was done during the last "Campaign" and will be, so we gather, in the next, may be put immediately into bags ready for despatch. Sometimes the wet pulp, before being passed through the oven, is mixed with molasses, some farmers preferring to feed the plain pulp and some the mixed food to their cattle. For adding the molasses there is a valve-controlled hopper-bottomed tank arranged over the conveyor—Fig. 14—which takes the pulp to the feeding hoppers over the drying ovens. Whether treated with molasses or not, all the pulp is sold for cattle food.

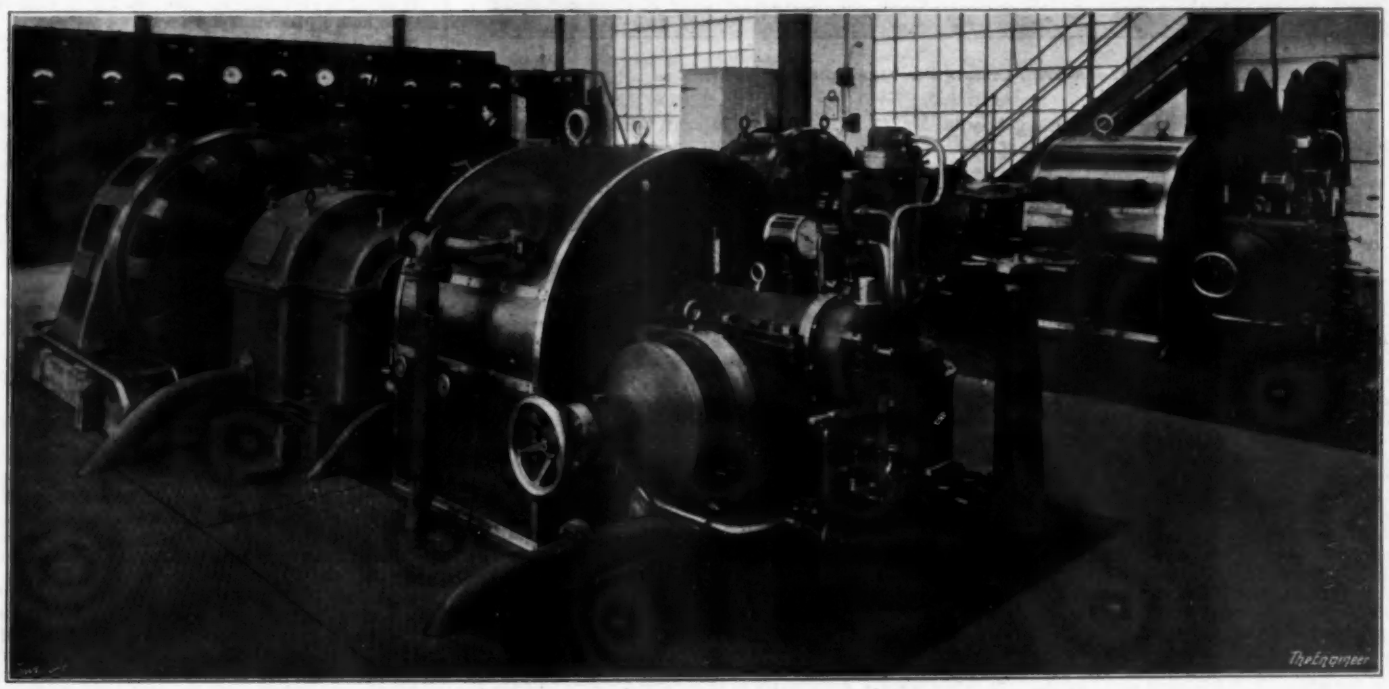


FIG. 16—1250-kVA TURBO-GENERATORS IN POWER HOUSE

It was explained at the outset that the whole of the factory is electrically operated, and, as a fact, all the necessary energy is generated on the site. For this purpose, there is first of all a battery of three land-type Babcock and Wilcox water-tube boilers, with chain grate stokers. These boilers, which operate

at 270 lb. per square inch pressure, and have an evaporative capacity of 79,000 lb. of water per hour, supply steam not only for the generators, but also for various heating processes in the factory. They are furnished with the ordinary indicating gauges, and with those for CO_2, CO, and H as well. In the power-house, which is an exceedingly lofty building, there are two 1250 kVA G.E.C.-Fraser and Chalmers turbo-alternator sets—see Fig. 16. The turbines are of the Fraser and Chalmers back-pressure type, which run at 6000 revolutions per minute. Each drives an alternator through gearing, which reduces the speed to 1500 r.p.m. The supply is given at 400 volts, three-phase, 50 cycles. The main switchboard—Fig. 10—comprises ten steel plate panels, with isolating links, and sheet iron divisions, and there are expanded metal doors at each end. In addition to controlling the alternators, this board also controls eight feeder circuits, which take current to power distribution boards for supplying the various motors throughout the works. In all, some 150 motors are employed. They are all of the "Witton" type, and they vary in size from quite small machines up to 180 horse-power, the combined capacity amounting to 3000 H.P. Most of them are of the pipe-ventilated or drip-proof pattern, and some, notably those for driving the centrifugals, have their spindles vertical. The power wiring is by means of Pirelli-General three-core, paper-insulated, lead-covered, double-tape, armoured cable for all the main circuits, and in the majority of runs between the distribution boards and the motors. There are distribution boards throughout the factory, and every circuit is fused independently.

Fig. 17—60-kW Alternator and Control Gear

For lighting purposes there are two G.E.C. transformers, one of 150 kVA and the other of 175 kVA capacity, with a voltage ratio of 400/230. They are oil-immersed and star-connected. To provide for emergency lighting in the case of failure of the main power plant there is a 200 ampère-hour storage battery with a discharge rate of 30 ampères for six hours, and for charging this battery there is a motor generator set. Emergency lighting circuits quite separate and distinct from the main lighting scheme have been run in all sections of the works, and on the lighting panel on the switchboard there is a contactor which, normally, is held in by a coil energised from the alternating-current supply. Should that supply fail, however, the contactor falls under the action of gravity and automatically switches those circuits on to the battery. In the main engine-room there is also a motor-driven air compressor for operating the water-conveying system for the beet. It compresses the air to a pressure from 15 lb. to 45 lb. per square inch and has a capacity of 1070 cubic feet of free air per minute. Its motor is of 85 H.P.

Only during the time that the "Campaign" is in progress is the main power plant in service. For use at other times there is in an adjacent building an entirely separate generator of 60 kW capacity, which is driven by a Ruston-Hornsby oil engine—Fig. 17. The supply is the same as that given by the main sets, and it is used for lighting and testing purposes, as well as in cases of emergency.

For the maintenance of the factory there are a small but efficiently equipped machine shop, and a carpenters' shop containing modern wood-working machinery. In the latter, any patterns which may be required for repairs or replacements of parts of machines are made. Adjoining these shops is a general store. All these three departments are arranged together under one roof. The oil engine just mentioned can be used for driving the workshop tools or, alternatively, its alternator by means of a belt through a clutch pulley. The alternator also acts as a synchronous motor during the progress of the "Campaign" and drives the workshop.

We have not seen the factory during the hours of darkness, but we understand that the lighting is of an entirely satisfactory character. For the railway sidings, coal, limestone, and beet dumps, and the roadways there are some thirty "Wembley" lanterns, each equipped with a 500-watt "Osram" gas-filled lamp. These lanterns are in some cases mounted on brackets that are clamped round the 30ft. steel poles, which are used for carrying the overhead conductors from the power-house to the various buildings.

The main factory is illuminated throughout by means of "Geco" enamelled steel dispersive reflectors and bowl-sprayed gas-filled lamps. Part of the illumination in the sugar house is also obtained from units arranged in the roof which flood-light through to the ground floor. For lighting the vacuum plant, small-angle type steel reflectors, containing 60-watt lamps, are provided to illuminate through the inspection covers on the tops of the vacuum pans, and there are further angle reflectors which can be raised and lowered over the five inspection holes, which are arranged in the side of each pan.

A great deal more might be written concerning this most interesting factory, of which we have only really been able to give a cursory account. To give a complete description of a modern beet sugar factory would, however, require a full volume to itself. To describe in detail the Allscott "water scheme" alone would demand more space than we have been able to devote to the whole factory. We must, therefore, content ourselves with what has been said, merely adding that the buildings, which were designed by Mr. C. W. Glover, A.M. Inst. C.E., of Westminster, are steel and concrete structures, the concrete being in the form of "Aerocrete."

In conclusion, we desire to express our thanks to the Shropshire Beet Sugar Company, Ltd., for permitting this description of the works to be published and for affording us facilities for visiting the factory. We also desire to thank the various representatives of the General Electric Company, Ltd., and of the Fraser and Chalmers Engineering Works with whom we came into contact for useful assistance during the preparation of this article, and would add a special word of thanks to Mr. K. Hampel, the Sugar Company's Chief Engineer and Technical Manager, who was indefatigable in his explanations and in answering our questions during the time that we spent at the factory.

The Institution of Naval Architects in Italy.

No. III. (*Conclusion*).*

The third and last paper taken at the meeting of September 18th was that on "Oil Films and Bearings," presented by Monsieur Brillié and Dr. A. M. Robb. A summary of this paper appears on page 382.

Oil Films and Bearings.

Mr. J. Hamilton Gibson, in opening the discussion, said the author's work was well known. By utilising a common-sense arrangement of oil grooves, reservoirs or basins he had reduced friction and wear, and, not content with that, he had recently published an interesting brochure showing by mathematical reasoning how far the actual results agreed with his theory. Last year Professor Goodman stated in a paper he read before the Institution of Civil Engineers in London that he had spent over five years in experimenting with journal bearings, but that the results were so erratic that he had thrown away two of them and had only presented the third set at the request of Sir Thos. Stanton. Such investigations as these were anything but easy to make. As was pointed out in the paper, a necessary condition for the proper working of a journal bearing was that the bearing must be larger than the shaft, thus providing a thin crescent of clearance into which the rotation of the shaft drags the oil and so sets up an internal hydraulic pressure on the lubricant upon which the shaft "floats" with a minimum of friction. If this crescent of clearance was carried too far round the shaft, then a negative pressure occurred in the oil film and intermittent metallic contact was caused owing to the unstable conditions. Mr. Michell had got over this difficulty by limiting the circumferential length of these "crescents" to 30 deg. or 40 deg. and repeating them, if need be, all round the circumference. Each fixed brass of the ordinary bearing was thus replaced by three or more loose pads closely fitting round the shaft, with just sufficient clearance for the oil to enter. Oil was supplied from an annulus in the housing to a longitudinal reservoir between each pair of pads, which were closed at the ends, and thus each pad formed its own pressure film independently of the others. The rotating shaft or spindle was therefore supported on as many oil films as there were pads, and metallic wear was not merely negligible, but was non-existent.

The paper was mainly theoretical and suggestive, and very little experience was recorded. Moreover, it dealt almost exclusively with journal bearings. It contained the rather naïve statement that "it is a reasonable deduction from ascertained facts that in plummer blocks, as in thrust blocks, perfect films of oil have been formed, with the load borne entirely on the oil," and later it was stated "the so-called wedge formation, such as always exists in a journal bearing, is not essential to the maintenance of a perfect film. Provided that the film is properly fed, it can maintain itself between parallel surfaces under high pressure." Mr. Hamilton Gibson said he agreed with all but the two last words "high pressure." High pressure was relative. He knew from actual experience that a Michell thrust or journal bearing will run astern, *i.e.*, on parallel surfaces up to 400 lb. or 500 lb. pressure per square inch, but only if the surfaces were short and well fed with oil. Beyond that load they became unstable and liable to break down, and in any case the running temperature was much higher than when running ahead on "wedge" films. Under ahead conditions such bearings would run sweetly up to 4000 lb. or 5000 lb. per square inch. The upper limit had never been reached. The author might be interested in a formula which he had used for frictional resistance of any fully lubricated bearing and which he had termed the R.S.V.P. formula :—

$$R = 0{\cdot}037 \sqrt{\frac{S V P}{L}}$$

R being the resistance of the bearing in pounds per square inch (0·037 is a constant),
S the speed in feet per second,
V the viscosity in absolute units,
P the load per square inch of projected area,
L the length.

From this could be deduced the heat generated in the oil, the frictional horse-power, the quantity of oil required, &c. This equation, added Mr. Hamilton Gibson, applied to all loads and speeds and may be thoroughly relied upon. As regards marine thrusts, one of his early geared turbine jobs in 1913 was fitted with the usual multi-collar thrust. Excessive wear occurred and it was found that the oil was being forced back through the syphons, no doubt owing to the arrangement of the oil grooves in the horseshoes. Taking a hint from a different arrangement of oil grooves in some turbine adjusting blocks, he cut wide radial grooves with well-rounded edges—not unlike those adopted by Monsieur Brillié—and no further trouble was encountered.

Mr. R. J. Walker said that the conclusions arrived at by the author appeared to agree generally with what had been observed from experiments with such bearings. Based on these conclusions, a new type of bearing was proposed in which practically all the bearing surface was cut away with the exception of about 30 per cent. at the bottom or load-carrying portion. The whole object of the arrangement appeared to be to reduce the effective bearing surface and consequently the frictional resistance. The same result would be obtained by reducing the length of the bearing to one-third, and it would be difficult to say without experimental tests whether the new proposal would be more satisfactory than merely reducing the length. The provision of the basins in the effective bearing surface was, so far as could be seen, merely the reintroduction of oil grooves which his firm discarded many years ago as being dangerous and liable to cause breakdown in the oil film. It was highly probable that a simple reduction of the length of a normal bearing would be more reliable. It was known that journal bearings would carry very much higher pressures than those adopted in practice, but there must be a reasonable margin of security, and the frictional losses in the journal bearings were so small that it would be a very unwise policy to endeavour to reduce them by sacrificing the margin of security in whatever manner that was done. Some figures were quoted at the end of the paper to show how great the saving might be, but those figures were difficult to reconcile with actual practice. It was also said that in large Atlantic liners the plummer

* No. II. appeared October 4th.

block loss might account for 5 or 6 per cent. of the total power in the installation. In any marine installation, the plummer block bearings rotated at such a very low surface speed that the frictional losses were negligible. The principal losses were in the high-speed bearings of the turbines and the gearing, which amounted to from 2 to 3 per cent. of the total power according to the size of the installation, but the plummer block losses were too small to be worth consideration.

Replying to the discussion, Dr. A. M. Robb, who remarked that his position was largely that of a translator of M. Brillié's work, said that he would deal in writing with the points raised. With regard, however, to the remark of Mr. Hamilton Gibson, that there was an absence in the paper of actual experience with the system, he might point out that records did exist from the year 1921, and M. Brillié had referred to some of the results in the summary he had given. It had been necessary to shorten the paper for publication, which had meant that the results had been cut out. These, he thought, might form material for a further paper.

The President, in bringing the two sessions for the reading of technical papers to a close, commented on the interesting discussions that had taken place.

Sir Archibald Ross proposed, and Mr. H. Ruck-Keene seconded, a hearty vote of thanks to his Excellency the Governor of Rome, Prince Boncompagni Ludovisi, for placing the Capitoleum at the disposal of the Institution for their meetings. Included in the vote of thanks was Admiral Sechi, whose work in connection with the praiseworthy arrangements in Rome had been the subject of repeated comment during the meetings and visits in that city. At the close of the meeting General Rota, on behalf of the Italian members, expressed his satisfaction that the Institution had chosen the city of Rome for its Summer Meeting.

The Institution Banquet.

The Institution held a banquet at the Grand Hotel the same evening, when his Excellency the Minister of Marine (Admiral Sirianni), his Excellency the Governor of Rome (Prince Boncompagni Ludovisi), and a large number of representatives of naval architecture in Italy were present. The President (Admiral of the Fleet the Right Hon. Lord Wester Wemyss) presided, and proposed the toast of H.M. the King of Italy, which was duly honoured.

The President, in proposing "The Royal Italian Navy and the Italian Mercantile Marine," referred to the need for nations to get together and discuss their differences, for by so doing they would find how little their differences were. The great desire of both Great Britain and Italy, and indeed of all the civilised countries, was to see the mercantile marine carrying out their peaceful work uninterrupted by strife, and the navies of the world not equipped for fighting each other, but for policing the seas and carrying on the peaceful trade of the world.

His Excellency the Minister of Marine (Admiral Sirianni) briefly acknowledged the toast on behalf of the Italian Navy, and proposed the toast of "His Majesty King George V."

The Hon. San Marco also replied in a few words for the Italian mercantile marine, both expressing sentiments of friendship and sympathy for the British naval and mercantile marine.

Mr. Francis Henderson, Vice-president of the Institution, speaking in both Italian and English, proposed the toast of "The Registro Italiano Navale ed Aeronautico," coupling with it the name of its President, Admiral Sechi, and spoke of the astonishing success achieved by this organisation since it was reorganised some years ago.

Admiral Sechi replied, and expressed his thanks for the appreciation that had been shown of what the Reception Committee had done for the visitors.

SOCIAL ENGAGEMENTS AND VISITS.

Visits in Rome.

During the meetings, by the kindness of his Excellency the Governor of Rome, the Capitoleum Museums were open to members of the party, many of whom availed themselves of the facilities offered. On the evening of Tuesday, September 17th, a dinner was given by his Excellency the Minister of Marine, in the new Palace of the Ministry, which has recently been built on the banks of the Tiber. Dinner was served in one of the long corridors of the building, and afterwards members were conducted over the principal apartments. The evening was a most enjoyable one. In the afternoons of Tuesday, Wednesday, and Thursday, visits were paid to monuments of especial interest in Rome, and some of the more recent excavations and restorations were inspected. The excursions included visits to the Pantheon, the Roman Forum, the Colosseum and the Palatine Hill, the Vatican Museum and Sixtine Chapel and St. Peter's. Interesting historical talks were given by Professor Reynaud, of Rome.

The Falls of Tivoli.

On the Wednesday afternoons a special visit was paid to Hadrian's Palace and the Falls of Tivoli, and tea was given at the Villa d'Este.

This visit was of particular interest to engineers on account of the new hydro-electric scheme, now in progress, the object of which is to utilise the whole of the energy of the river Aniene, between Fiumerotto and Acquoria, without spoiling in the daytime the natural beauty of the Tivoli falls and the lesser falls and fountains of the Villa d'Este. The work is being carried out by the Consorzio Idro-Elettrico Dell'Aniene which is allied with the Government of Rome and its gas and electricity undertakings.

The first diverting of the flow is at a height above sea level of 236·6 m. at Fiumerotto, and the second diversion is at Cunicoli Gregoriani, at a height of 214·5 m. The discharge at Acquoria is at 48 m. above sea level. The first plant is to be installed at Arci, and will utilise the head of 19·5 m. between the first and second diversion of flow, the maximum flow being from 30 to 35 cubic metres per second, while a second plant will utilise the head of 160 m. with a maximum flow of 33 m. per second between the second diversion and the discharge. Three large storage reservoirs have been constructed, one near the Fiumerotto diversion with a capacity of about 190,000 cubic metres. This reservoir has been made by raising the existing dam by 2·5 m. There is also a 400,000 cubic metre reservoir in the Empiglione Valley, which receives the water discharged from the Arci plant and passes it to the lower reservoir near the second diversion, which has a capacity of 120,000 cubic metres and supplies the high-pressure tunnel to the new power station at Acquoria Nuova. The high-pressure tunnel runs through the hill of Tivoli, and is 1100 m. long. It is bored vertically for 60 m., and then runs at a uniform inclination with a gradient of about 1 in 11, ending in a 100 m. horizontal portion. About 700 m. are lined with concrete, which is reinforced with double electrically-welded rings and partition bars, about 400 m. consists of steel pipe with expansion boxes. Three other smaller plants will be used to utilise the head of the larger and smaller waterfalls. In the main power station, which was visited, there are to be installed three vertical turbine sets, each of 16,000 kVA capacity, two of which are now being put in.

Caligula's Galleys.

Another interesting visit was that paid on the morning of Thursday, September 19th, to Frascati and Lake Nemi, where one of the Roman galleys, or house-boats, of the Emperor Caligula, was examined. The Lake of Nemi is situated in a finely wooded volcano crater, and it has been partly drained by pumping the water into an old aqueduct through which it is discharged to the plain and to the sea.

The party was personally received by Colonel V. Malfatti, who was in charge of the Government investigations of 1894–1905, and who is now again devoting his energies to the task of recovering the galleys and drying them in such a manner that the wooden structure may be preserved with the object of forming a special naval museum on the lake below the Castle of Nemi, in which the galleys may eventually be housed. Members of the party were allowed to inspect the galley and to see some of the more interesting metal articles which have been recovered. One of these was a large bronze stop-cock, evidently lathe turned, which was easily moved by hand, in spite of its long emersion. In a later article we hope to deal more fully with these interesting nineteen-century old ships.

The Rome Tank.

On the afternoon of the same day, after visiting the Vatican City, several members accepted the invitation of General G. Rota to inspect the new Italian National Experimental Tank at Rome, which has been erected on a site near St. Paul's Basilica, presented by the City. The tank and administrative buildings are constructed in ferro-concrete. The tank has a length of over 900ft. with a breadth of 41ft. and a depth of 20ft. 6in., and it contains about 18,000 tons of water. The carriage and model making equipment has been supplied under the supervision of Dr. Gebers, of Vienna, by Austrian firms.

At the time of the visit the tank was about three parts full, and it is hoped to complete the work and begin tests within a few months' time. The party was conducted around the tank by its President, General G. Rota, who was assisted by his chief engineer, Mr. Renato de Santis. In a later issue we hope to return to this subject.

Visits at Naples.

On Friday morning, September 20th, the members left Rome for Naples, which was reached shortly before mid-day. The party was officially welcomed by Signor Biagio Borriello, the chairman; Engineer A. E. Gobbe, the general director of the Società Anonima Officine e Cantieri Partenopei, and other members of the Reception Committee. On arrival at the hotels, members found gifts of fruit and flowers awaiting them, which had been sent by the kindness of Signor and Madame Borriello. In the afternoon the ladies visited places of interest near Naples, while the main party was conducted over the new port and harbour works and through the shipyards, repair shops, dry docks, and engine works of the Società Anonima Officine e Cantieri Partenopei; which undertaking was formed about a year ago to administer the combined businesses of the Officine Meccaniche e Navali di Napoli, the shipyards of T. T. Pattison and the Bacini e Scali Napoletani. The new harbour works include the building of dry docks and quays, which were inspected under the guidance of the assistant harbour engineer. Some ships were undergoing repairs, and it was of interest to see the two new 1700-ton displacement Roumanian destroyers "Regele Ferdino" and "Regina Maria," which have recently been completed at the Pattison shipyard in collaboration with John I. Thornycroft and Co., Ltd., of London. These vessels are propelled by Parsons turbines, and have completed very satisfactory trials. In the engine works visited, some large turbines of the "Belluzzo" type, which were being built for the Italian cruiser "Fiume," were inspected, and interest was shown in the special blading used. An optical method of determining the out-of-balance forces on a ship's propeller was also demonstrated. On Saturday, the party was divided into two groups, enabling the buried city of Pompeii and the ascent of Vesuvius to be made the same day. Although on arrival at Naples the mountain top was clear, and the dense columns of steam arising from the crater was clearly seen, the visitors were not so fortunate on the Saturday, and very little was seen of the actual crater owing to the mist and rain. The two groups met at luncheon at the Hotel Suisse Pompei, where they were entertained by the Provincial Council of Naples. Mr. Francis Henderson, the Senior Vice-president of the Institution of Naval Architects, proposed a vote of thanks to Signor Borriello and his committee for the excellent arrangements made. In the evening the party was invited to attend an open-air concert at the gardens of the Royal Theatre, at which Neapolitan songs were sung to orchestral accompaniment. This music was much appreciated.

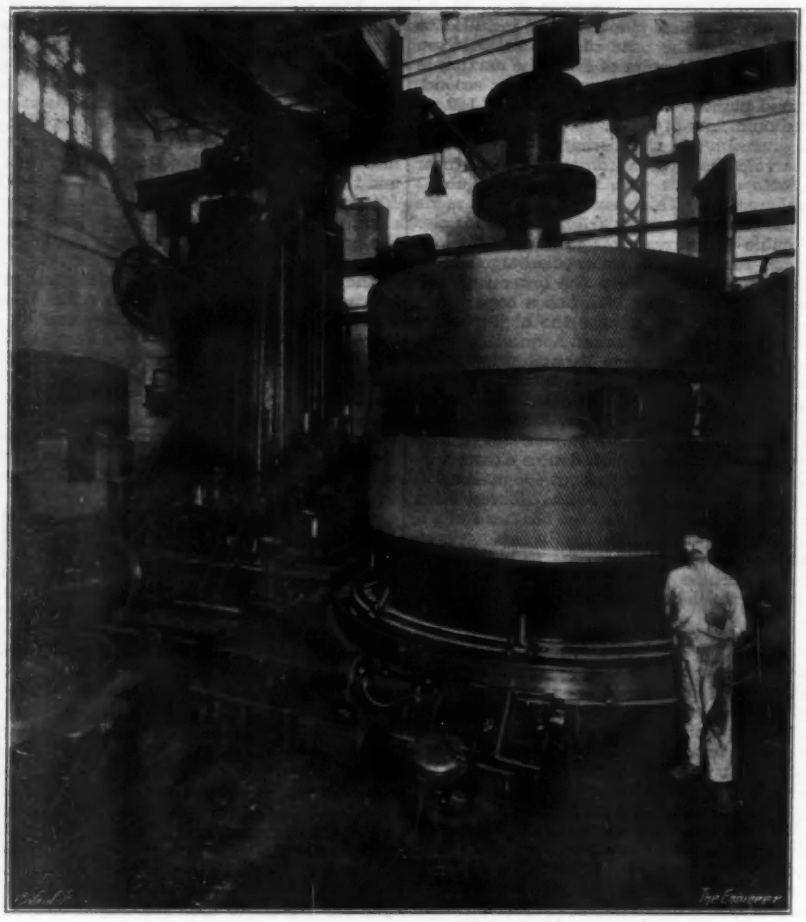
On Sunday morning members embarked on the express liner "Esperia," of the Società Italiana Di Servizi Marittimi, or "Sitmar" Line, which is a regular ship in the company's Alexandria–Genoa service. The voyage, thanks to the special facilities offered by the owners, was a delightful one, and Genoa was reached at breakfast time on Monday morning. The "Esperia" was built in 1919 at Riva Trigosa, and engined by N. Odero and Co., of Sestri-Ponente. She has a gross tonnage of 11,500 and a displacement of 12,500 tons. Her propelling machinery comprises two sets of high-pressure and low-pressure single-reduction geared turbines, and there are ten oil-fired boilers of the Scotch type. The maximum output of the machinery is over 24,000 horse-power, and on trial the ship attained a speed of 21·4 knots. In service, however, a speed of 17·5 knots is usual, and a little over half the boilers are required under these conditions, giving very ample stand-by plant. The public rooms are fittingly decorated for the service, and the passenger accommodation and service is of the best.

Shipyard and Port Visits at Genoa.

On arrival at Genoa, the party was conducted to the hotels, and almost immediately left again to visit the yards and engine works of N. Odero and Co., at Sestri Ponente, and the shipyards and shops of the Società Anonima "Ansaldo." In the Odero shipyard, which has just succeeded in securing the order for two Greek destroyer leaders, at a price much lower than that quoted by British firms, two Argentine scouts and two gunboats for Paraguay, as well as a motor cargo boat, were on the stocks. In the engine works the water-tube boilers and the 6000 S.H.P. geared turbines for the Argentine scouts were seen in course of erection, and also similar machinery for the Italian 10,000-ton cruisers "Zara" and "Gorizia," now being built at Spezia and at Leghorn. The excellence of both the steel and the iron castings was commented upon, and the intense activity in both the shipyards and shops was also noted.

The next visit was paid to the shipyard and engine works of the Società Anonima "Ansaldo" at Sestri Ponente, Sampierdarena and Cornigliano Ligure. A full description of the Ansaldo works will be found in a special Supplement to The Engineer of May 8th, 1914. The slipways, which are well served with tower cranes, can accommodate vessels up to 1000ft. in length, and the liner "Roma" was built at this yard. In addition to Italian cruisers and cargo ships, a pontoon crane designed for lifting large stone blocks for the Genoa Harbour Board was inspected. The pontoon is equipped with electrically driven capstans and winches, and power is furnished by a 220 B.H.P., 428 r.p.m., Ansaldo-M.A.N. type, airless injection engine. In going through the shops it was possible to examine in course of manufacture and erection several of the geared turbines for the new Italian 10,000-ton cruisers, which will have a designed speed of about 37 knots. The turbines are of the "Belluzzo" single-reduction geared impulse type, and the combined total output of the two sets is 100,000 S.H.P. The main gear wheel speed is 300 r.p.m., with a high-presssure turbine speed of 2070 r.p.m. and a low-pressure turbine speed of 1790 r.p.m. The gear wheels have two faces of 89 cm., or over 2ft. 11in., which is a remarkable width. One of the gear wheel units seen at Trieste is shown in the

accompanying illustration. It is generally similar to the gears inspected at the Ansaldo works. The Weir regenerative condensers and the 350 lb. pressure water-tube boilers for these ships were also seen going through the shops. One of the turbine units was arranged for bench tests in a well-equipped test room, replete with all measuring appliances. After viewing the shops it was with no little interest that the members of the party learned that, at the request of the management, the workmen in all departments had consented to work through the dinner hour in order to give the British visitors a correct impression of the works as seen during the ordinary working hours. Luncheon was served at the "Ansaldo" head offices at Genoa-Cornigliano, and General Ugo Cavallero, the President of the Ansaldo company, gave an official welcome to the guests, Lord Wester Wemyss, replying on behalf of the Institution of Naval Architects.



GEAR WHEEL CUTTING AT ST. ANDREA ENGINE WORKS, TRIESTE

The New Port Works at Genoa.

On leaving the Ansaldo offices, the ladies visited places of interest in Genoa and the gentlemen were conducted around the new harbour works. The party embarked at the headquarters of the Royal Italian Yacht Club in Genoa, and an excursion in two steamers was made around both the old and the new port. The old, or inside, port contains the main passenger quays and warehouses, and near the principal railway station a very fine new maritime station, with Customs offices, is being built on the first of the new quays. Special landing facilities for large liners are provided. The new port works are being carried out on the lines of the port of Marseilles, and ultimately eight new quays will be built running out almost at right angles to the coast and protected by a long outer breakwater. This breakwater is so constructed that ships will enter at one end of the basin and leave at the other. Up to the present three of the new quays have been completed and others are in course of construction. Owing to the very heavy gales which have to be withstood, very large blocks are employed and are let down on to a rock foundation. A crane for performing this work was, it will be recalled, seen in the Ansaldo yard. It has a designed lifting capacity of 450 tons and it will carry the blocks from the casting site to the desired positions. The new port is well equipped with lifting appliances, and a very large power station forms part of the scheme. This station is provided with large coal bunkering plants and there are oil fuel storage facilities. On the land a fine new road, cut through a promontory to connect Genoa and Sampierdarena, has recently been opened. Some new dry docks are being built and others are projected. When the works are complete both the old and new ports will be well protected and well equipped in every sense. After visiting the port the party was entertained to tea on the "Roma" of the Navigazione Generale Italiana. This fine liner is a 32,000 gross ton ship, propelled by quadruple-screw geared turbines.

The first visit on Tuesday morning, September 24th, was paid to the Podestá (Mayor) of Genoa, who received his guests in the historic City Palace, in which autograph letters of Christopher Columbus are preserved. Later, the Foce shipyard of N. Odero and Co. was visited, where the 6000-ton Argentine cruiser "Almirante Brown" was almost ready for launching. This ship has a length of about 530ft. and her geared turbine machinery is of the order of 80,000 S.H.P. This yard will shortly be closed in order to complete certain new streets in Genoa. An interesting visit was paid the same morning to the Royal School of Naval Engineers, where the party was received by one of the directors, General E. de Vito, of the Ansaldo Company. The Regia Scuola di Superiore Navale was founded in 1870, and from 1874 the education of naval officers has been entrusted to the Royal School at Genoa. Up to last year over 1069 students have passed through the school. An interesting feature of the curriculum is that each student takes simultaneously a course both in hull design and marine engineering which qualifies him to take the final diploma of Ingegnere Navale e Meccanico, linking up the naval architect with the marine engineer. The Italians claim that such a combined education is more sound than specialisation at an earlier age.

After leaving the school the party motored to Portofino, where luncheon was given by the School at the hotel, from which a very remarkable view of the coast of the Italian Riviera is obtained. On the way back to Genoa members were received at the gardens and museum of Nervi by the Mayor of Genoa, and tea was served In the evening a dinner was given on the liner "Conte Grande" by the Lloyd Sabaudo Company. This vessel is a sister ship to the "Conte Biancamano, which, along with two other ships, was built by Beardmores, Ltd., for the same owners—see The Engineer for November 13th, 1925. The "Conte Grande" was, however, built and engined by the Stabilimento Tecnico Triestino and launched from the San Marco shipyard. She is a 651ft. ship of 25,600 tons and is propelled by 26,000 S.H.P. geared turbines. The decorative schemes were much admired.

La Spezia Dockyard.

The visit paid to the Spezia Dockyard on Wednesday, September 25th, will long be remembered for the cordial welcome and hospitality extended by the Royal Italian Navy and the Odero-Terni Works. An early start was made from Genoa and special railway coaches were provided by the Minister of Communications. The party was received at La Spezia with naval and musical honours and was conducted round the dockyard. A fleet of naval pinnaces was waiting to take members to the shipyard, where the 10,000-ton cruiser "Zara," which is in an advanced state, was inspected. During the morning a visit was paid to the well-equipped Odero-Terni gun shops, part of which are now employed in the manufacture and assembly of electric locomotives for the State Railways. A luncheon was given at the Hotel Royal and Croce di Malta, by the Odero-Terni-Società per la Construzione de Novi Macchine ed Artiglierie, of La Spezia, and after luncheon three service destroyers of the Royal Italian Navy, flying the Union Jack at the foremast, were placed at the disposal of the party, which was taken out to sea and round the Gulf of Spezia, tea being served on board. This unexpected cruise on three of the most modern Italian destroyers was much appreciated by all. The three ships were the "Ostro," "Espero," and "Pepe," and a special feature of interest on the last-named destroyer was the new Mainelli rudder, which during the last year has been tested on a naval vessel at speeds up to 22 knots. It is now being adapted for speeds up to 38 knots, and it is hoped that the results of the tests will shortly be made known. The inventor claims a 3 per cent. increase in the speed of the vessel, owing to reduced resistance, and almost a 50 per cent. reduction in turning circle with less heeling. The rudder consists of a section of a bell, which is pivoted obliquely to the underside of the ship. With the rudder in mid position the complete rudder casting is housed within the hull and there are no projections whatever. When it is desired to turn the ship the sector is rotated on its axis and part of it enters the water, giving the desired turning effect. The inventor has also patented a bow rudder of the same type. So far hand operation has been shown to be quite satisfactory. Before leaving Spezia Lord Wester Wemyss thanked the naval authorities for their magnificent welcome.

The Visit to Turin.

Although it was arranged after the main programme had been fixed, most of the party availed themselves of the invitation of the Fiat Company to visit the Fiat oil engine works and motor car factory at Turin. Cars were waiting, which took members to the works of the Fiat Stabilimento Grandi Motori, where the new machine shops and heavy foundry were inspected. The single-cylinder 2000 B.H.P. experimental engine, already described in The Engineer, was shown running, and alongside it was a 2400 B.H.P. marine engine for a cargo ship. In other parts of the shop we noted small high-speed Diesel engines for submarine, locomotive and commercial vehicle work. We hope to refer to the foundry and its equipment in a later article. On arrival at the motor car works the party was driven through the various departments at a moderate speed, ascending from floor to floor on the special ramps which are formed at the ends of the main building. The cars finally emerged on the testing track on the roof of the works, where the visitors were photographed and prints presented to them in a very short space of time. It was interesting to learn that, unlike many American motor car factories, the Fiat Company actually makes from 70 to 80 per cent. of the parts and bodywork, besides assembling and testing the finished cars. A luncheon was given by the Fiat Company at the Grand Hotel Europa, Captain G. Bosselli presiding in the unavoidable absence of the president of the Fiat Company, Senator G. Agnelli, who had been called to Rome. The Podestà of Turin also spoke in English and welcomed the visitors to his city. After luncheon the Podestà invited the party to view the City Palace and afterwards visits were paid to the Colle della Maddalena war memorial and the Royal Palace of Stupinigi. After tea the visitors were afforded an opportunity of seeing the town of Turin from the motor cars, and before leaving for Trieste in special sleeping cars a dinner was given at the Station Restaurant by the Registro Italiano Navale ed Aeronautico.

Visits to Trieste and Monfalcone.

Those members of the party who travelled direct from Genoa to Trieste met the members from Turin on Friday morning, September 27th, at Trieste. After visiting the hotels, cars were in readiness to take the party to the engine works of St. Andrea and the San Marco shipyard of the Stabilimento Tecnico Triestino. Those works are famous for the large liners, steamships and motor vessels built in the post-war years. We shall refer to them in a later article.

The visitors were greatly impressed by the well-designed equipment and the activity shown in these works.

Luncheon was served at the Hotel Savoia and was given by the "Federazione Fascista degli Armatori dell'Adriatico Orientale" and the "Union Industriale Fascista della Venezia Guilia." In the afternoon, by the courtesy of the Minister of Communications, an excursion to the world-famed grottos of Postumia was made. These stalactite caves are possibly among the finest of their kind in the world, and a trip was made through them in a small oil engine-driven train. The natural beauties of the grotto, which are enhanced by cleverly designed lighting effects, were much enjoyed. It was of interest to the visitors to learn that there are over 33 kiloms. of railway track in these caves, and that motor boats can proceed over 6 kiloms. on the underground waters. On returning

from Postumia the party met again on the Cosulich motor liner "Saturnia," at a dinner given by the Cosulich Line, at which Mr. Antonio Cosulich presided.

The following day a visit was made to the Monfalcone shipyards of the Cantiere Navale Triestino, where the members were received by Mr. Augusto Cosulich. The aeroplane works were inspected and machines for the Cosulich S.I.S.A. Line were seen in course of construction, also flying boats of the "Santa Maria Savoia" type, of both wood and duralumin construction. At this yard several Italian submarines of the "Fratelli Bandiera" class were seen on the stocks and fitting out. Several vessels for foreign owners were being built and considerable interest was shown in the specialised method of shipbuilding which has been evolved in the Monfalcone yards. We shall refer to this method in a subsequent article. The vessels being built included a motor passenger vessel for Spanish owners and a 3000-ton deadweight cargo ship for Portuguese owners, which is being built under the supervision of A. T. Wall and Co., of Liverpool. The firm has also on hand a large motor vessel for the Lloyd Triestino Company. The visitors were afforded an opportunity of seeing some of the welfare work and an exhibition of dancing was given in the theatre attached to the yard. The Military Cemetery at Redipuglia was visited and a wreath was laid on the war memorial. Luncheon was given at the Shipyard Hotel, and Mr. Auguste Cosulich presided and welcomed the visitors. At these later meetings the President, Lord Wester Wemyss, expressed the sincere thanks of the members to the Italian hosts for the magnificent reception which they had been given, and expressed the good wishes of the party for the prospects of the shipbuilding industry, both in Italy and Britain. Sir Archibald Ross thanked the President for his leadership and Mr. R. W. Dana, the Secretary, gave a brief outline of the arrangements which led up to the Italian meeting, and which had been so ably carried through by Admiral Sechi and the members of his reception committees in Rome, Naples, Genoa, and Trieste. The final function was a reception by the Podestà of Trieste in the City Palace. Many of the members also visited Venice.

The Italian summer meeting of the Institution of Naval Architects was one of the longest of the foreign visits in recent years, but it will stand out among those visits on account of the warmth of hospitality, the added knowledge of economic and industrial conditions in present-day Italy, and the many friendships made, which will bind together our two countries. In this necessarily short review of the visits it has not been possible to mention the many interesting speeches made at the various functions. For these, it is hoped that some permanent record will be found in the "Transactions" of the Institution. The members owe much to Mr. R. W. Dana, the Secretary, and to his assistant, Mr. A. Dansie, for the work they have done in co-operation with the Italian Reception Committee, which made the visit in every way the most memorable and successful one of recent years.

Physical Society's Exhibition.—The twentieth annual exhibition of electrical, optical, and other physical apparatus is to be held by the Physical Society and the Optical Society on January 7th, 8th, and 9th, 1930, at the Imperial College of Science and Technology, South Kensington. As on previous occasions, there will be a Trade Section and a Research and Experimental Section, and, in addition, a new section for the work of Apprentices and Learners is to be introduced. The Trade Section will comprise the exhibits of manufacturing firms, and preliminary invitations to these exhibitors have already been issued, entries being asked for by October 18th. The Research and Experimental Section will be arranged in three groups:—(*a*) Exhibits illustrating the results of recent physical research; (*b*) lecture experiments in physics; (*c*) historical exhibits in physics. The Section for Apprentices and Learners has been instituted with the object of encouraging craftsmanship in the scientific instrument trade. Apprentices and learners may exhibit, in competition, specimens of their work, providing they are in the regular employ of a firm which subscribes to the Prize Fund, and which is exhibiting at the next annual Exhibition or has exhibited once during the past three years. Further particulars will be sent on application to the secretary of the Society, 1, Lowther-gardens, Exhibition-road, S.W. 7.

The Institution of Production Engineers.—A change has been made in the constitution of the Institution of Production Engineers, which, it is believed, will lead to more effective work and greater efficiency generally in the conduct of the affairs of the Institution. The Institution was formed some years ago because it was felt that the Institution of Mechanical Engineers did not afford the necessary facilities for the discussion of the more intimate and detailed workshop and production problems with which production engineers are continually faced. During the past year or two it has gradually been realised that something on a larger scale is necessary, and therefore a new constitution has been created. Hitherto, London has been regarded as the headquarters of the Institution, although there are branches at Birmingham and Coventry, which, being centres of engineering production of many kinds, have been able to provide the largest meetings and the best discussions, and it almost seemed at one time that the headquarters of the Institution would be moved to Birmingham. The course decided upon, however, has been to appoint a general secretary for the whole of the Institution, which will continue to have its President and Council as hitherto, with offices in London, but to constitute London a branch of the Institution on the same lines that Birmingham and Coventry are now branches, each branch in future to have its own President and Committee working under the general supervision of the main Council. At the present time, Sir Alfred Herbert is President of the Institution, but he will be succeeded very shortly by Mr. Tom Thornycroft, whilst Mr. A. J. Hancock has been elected President of the London branch, with Mr. Gordon England as Vice-president. One of the aims of the new *régime* is to get away from a rather pronounced tendency in the past to regard the work of the Institution and the Production Engineer almost solely in terms of motor car production, nearly all the papers and discussions being upon this section of engineering. A much wider field is to be covered in the present session.

Low-Temperature Carbonisation Plants in London.

By JOHN B. C. KERSHAW, F.I.C.

No. II.* (*Conclusion*).

The Hird Retorts at Richmond.

The Hird process resembles the original Coalite process in the fact that it is based upon the carbonisation of the coal in vertical cast iron retorts, and that the charging and discharging are intermittent in character. The controlling rights of the process are owned by British Carbonized Fuels, Ltd., and the eight retorts which have been erected at the Richmond works of the Gas Light and Coke Company were constructed by Messrs. Woodall-Duckham and Co. The plant at Richmond embodies many improvements upon the retort design of the original experiment plant, and Fig. 6 shows a plan and two elevations of this improved plant, the various portions of which are explained by the attached key.

The installation consists of a bench of eight retorts, each 14ft. high by 6ft. 6in. in length, and tapering from 10in. in width at the top to 14in. in width at the bottom. The special feature of the Hird retort is the provision of six pokers or stirrers in each retort, in order to keep open a passageway through the coal during carbonisation. These rotating pokers are of suitable cross section for the purpose of maintaining cavities in the centre of the charge of coal, and they, therefore, serve the double purpose of facilitating the escape of the gases and at the same time they consolidate the charge of fuel in the retort. The pokers are suspended at approximately 12in. centres along the length of the retort, and reach within 3in. of the bottom. They are of diamond shape in cross section, and consequently when revolved they produce a hole of greater cross-sectional area than that of the poker itself, and thus leave a passageway for the escape of the gases. They are operated by worm drive, and make a complete revolution every two minutes. The power required for operation of these pokers is only ¼ H.P. for each retort, and the carbonisation of the whole charge is completed as a rule in twenty-four hours.

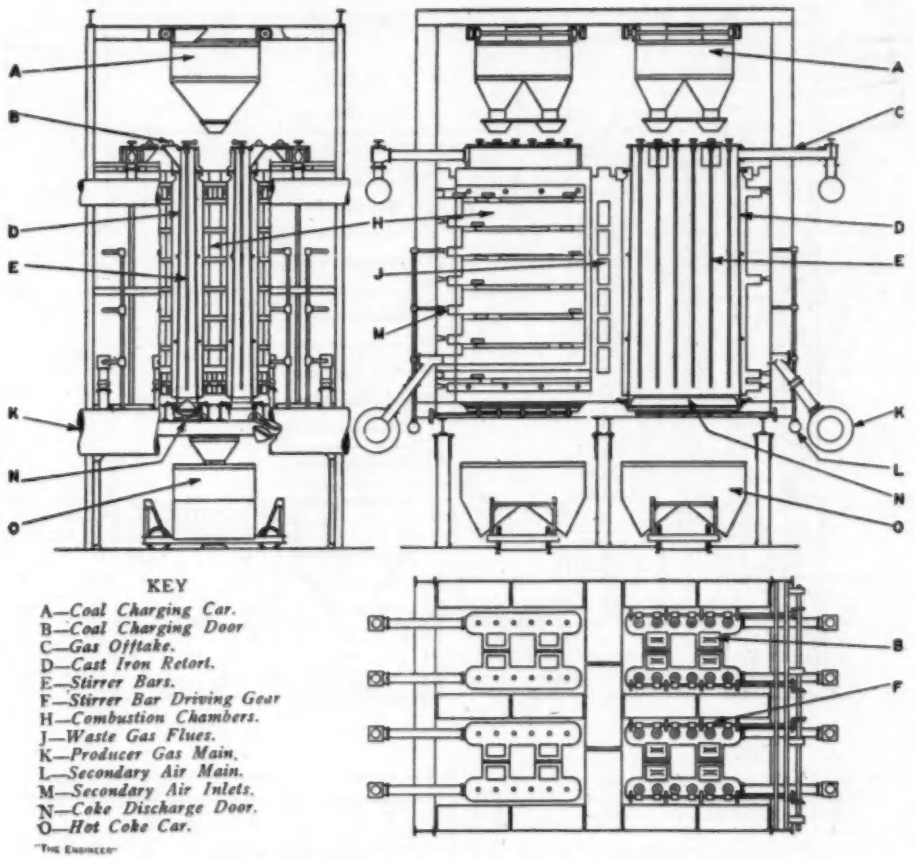


Fig. 6—Hird Retorts at Richmond

The coal employed is a slack from run-of-the-mine coal, passing ½in. screen, and this small coal is elevated to the overhead bunkers, a separate bunker being provided for each set of four retorts. The coal is discharged as required into cars of 2½ tons capacity, shown in Fig. 6, which run along tram lines above the retorts, and a small compartment is provided in these cars for coke breeze, since a small quantity of this is passed into each retort before the charge of small coal. The retorts are constructed of a special grade of cast iron and are heated by producer gas up to a temperature of 620 deg. Cent. Discharge doors are provided at the bottoms of the retorts, and at the end of the run these doors are opened and the carbonised fuel is dropped into the cars shown in Fig. 6. These cars are then run under the quenching tower, and the hot coke is submitted to the usual treatment with water for cooling purposes. The semi-coke produced by the Hird retort is stated to be hard and dense, and to contain about 8 per cent. of volatile matter, and as very little "breeze" is produced, nearly the whole of the carbonised product is saleable as a domestic fuel.

The theory upon which the Hird process is based is that when a retort has been charged the coal nearest the retort wall will soften and form a plastic layer, which prevents the escape of the gases between the coal charge and the side of the retort. These gases therefore are compelled to pass inwards to the cavity which is maintained in the centre of the charge by the revolving pokers, and a further advantage of these cavities is that by enabling the gas to escape quickly from the hottest zone of the retort, the risk of cracking of the primary oils is avoided and some of the sensible heat of the evolved gases is transferred to the newly charged fuel in the upper portion of the retort.

As stated above the carbonised fuel is dense, and about 1½ cwt. can be filled into one of the ordinary size of gas coke bags.

The gaseous products from the retort pass away to the hydraulic main, where the heavy oils are condensed, and the remaining gas passes on to coolers, and is treated as in ordinary gasworks practice. The low-temperature oil obtained from the Hird retort contains approximately 30 per cent. of tar acids, the remainder being light spirit and neutral oils. The specific gravity of the oil is 1·03, and it is entirely free from tar and solid carbon. It can be treated with caustic soda, therefore, for removal of the tar acids, without previous distillation.

The gas obtained is of high calorific value, and appears to be similar in all respects to that produced from other externally heated low-temperature retorts. No figures have been published for the yields or results obtained with the installation of the Hird retorts at Richmond, so that it is impossible to make any comparison of running costs or efficiency with those obtained from the other plant at Richmond.

The Fuel Research Board's Plant at Richmond.

The Gas Light and Coke Company, when requested by the Government in 1927 to examine all the then existing low-temperature carbonisation plants in this country in order to select the process and retort best adapted for operating in conjunction with the London gasworks, selected for the purpose the retort and process which had been developed by the chemists and engineers of the Fuel Research Board at their experimental station at Greenwich. At the Fuel Research Station it has always been considered that any process of low-temperature carbonisation which was to be successful commercially must be reduced to extreme simplicity. The retort designed for the Fuel Research Station experimental trials, therefore, was a simple cast iron retort mounted inside a simple

* No. I. appeared October 4th.

brickwork setting. The experience obtained with this type of cast iron retort at Greenwich was discussed by the representatives of the Gas Light and Coke Company, the Fuel Research Station and of the Woodall-Duckham Company before the erection at the Richmond plant. As the result of this discussion, certain modifications in the design were adopted. The general arrangement of two of the retorts and a section of one of the heating walls is shown in Fig. 7. The retorts are erected in four sections and are 21ft. in height, the inside measurements being 6ft. 6in. by 7in. in width at the top, tapering to a width of 11in. until within 2ft. 7in. of the bottom of the retort, where the tapering increases so that the final width and length is 13in. by 6ft. 10in. This flared shape at the bottom has been adopted because experience shows that the middle section of the retort tended to bulge when in use. This expansion of the centre had resulted in some of the retorts at the Fuel Research Station having a constriction at the base which obstructed the discharge of the carbonised fuel. It was hoped that the altered design would overcome this difficulty.

The retorts at Richmond are built in four sections,

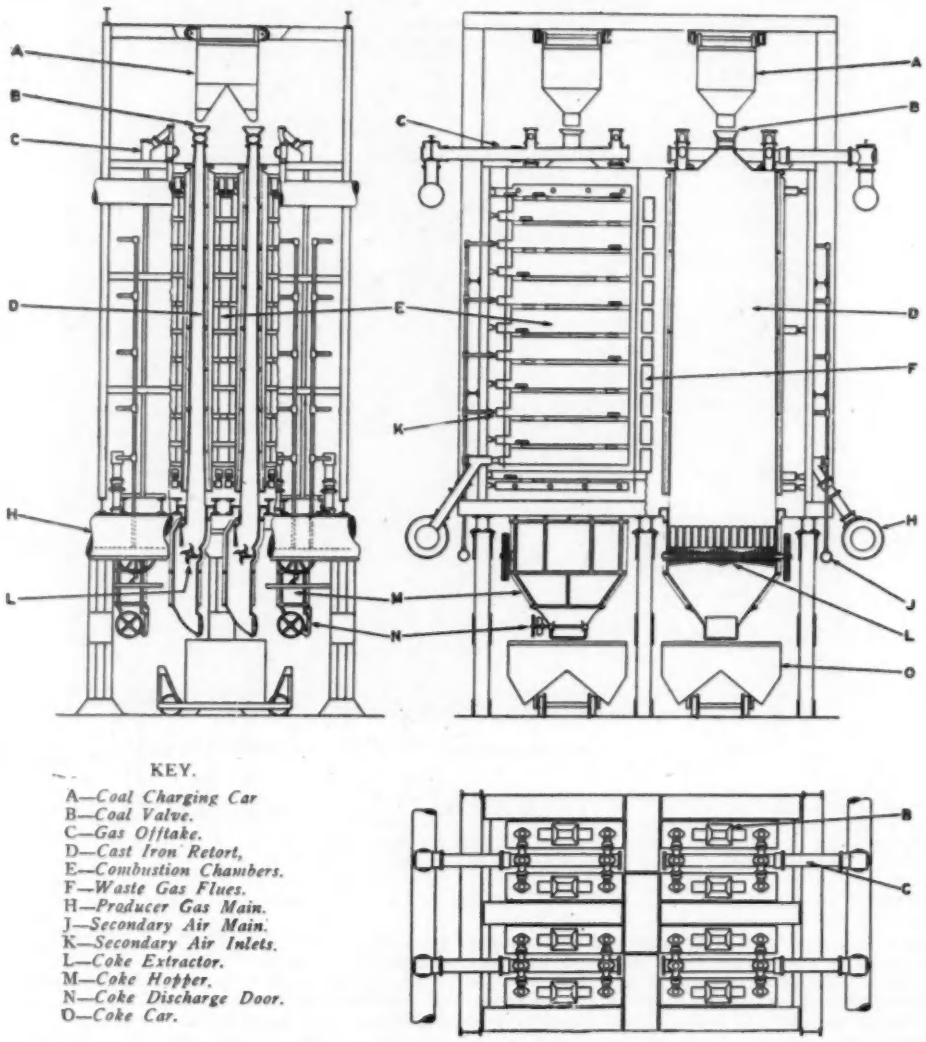


FIG. 7—FUEL RESEARCH BOARD'S PLANT AT RICHMOND

each section made up of two side plates and two end plates. In order to obtain information as to the most reliable type of cast iron to employ for construction of these retorts the following different types of iron were used:—(*a*) A low silicon iron; (*b*) a cold-blast iron; (*c*) another low silicon iron; (*d*) a "perlite" iron.

The retorts are built upon brickwork bases, which rest, in turn, on cast iron coke chambers into which the coke is discharged by means of a modification of the Woodall-Duckham type of extracting gear. A discharge door of a special design is fitted also to each coke chamber, and the coal is charged into the retort through a circular valve raised 12in. above the casting which covers the upper end of the retort. The gas outlet is at each end of this casting, and the gas discharges from each pair of retorts into a short dry gas main in which sprays of liquor are employed to precipitate the dust.

The original system of heating these vertical retorts at the Fuel Research Station had proved quite efficient, but it involved the use of a very large number of controlling cocks and adjustments. An alternative system of heating, therefore, is employed at Richmond which gives full effect to the radiant heat from the brickwork, but prevents the flame of the burning gas impinging upon the retort. The control cocks are also reduced to a minimum.

By this method of heating the open vertical burners are replaced by hollow walls, which separate each retort from the neighbouring one. These walls are constructed with zigzag flues and are provided with a single burner at the base through which the whole of the gas is supplied. A portion only of the air required for combustion is supplied through this burner and the additional air is supplied at several higher levels at the points where the gases change their direction, *i.e.*, at the ends of the zigzag passages. At the top of this hollow wall the burnt gases pass out through a series of ports and are drawn downwards into the space between the hot wall and the retort and are finally led away to the chimney by means of a bottom flue.

As a precautionary measure to protect the iron of the retort from the direct flame of the burning gases, steel baffle plates are placed round the retort immediately opposite the openings from which these gases issue, so that if by any chance flaming gas does issue from these orifices no great damage will be done to the metal of the retort. The last chamber in the hollow wall is divided longitudinally, and since the ports leading into these two passages are regulated by dampers, it is possible to divert any portion of the flue gas from the retort on either side of the wall. The common flue, into which the waste gases ultimately pass, runs the whole length and height of the bed and is situated between the two halves of the setting, which are placed back to back. The bench of retorts at Richmond consists of two rows of twenty, and the supporting brickwork in the flue chamber has to be of considerable thickness in order to bear the strain of the tie rods which hold the two sides of the setting together.

The producer gas required for heating the forty retorts is obtained from four producers of the standard stepped-grate type. They can each be shut off as necessary, and they supply the gas through two steel gas mains lined with fire-brick, 2ft. 6in. inside diameter. The producer gas is supplied to the retorts through 6in. butterfly valves, which govern the burners described above. The air required for combustion is supplied by motor-driven fans, and is distributed through two 12in. air mains which run parallel to the gas mains. Distributing pipes are connected to these mains for each wall and the air supply from these distributing pipes is governed by a cock at the bottom. At each other position in the wall where air is admitted the supply is governed by an orifice diaphragm of a certain size. It is thus possible by regulating the cock at the base of the air supply and the valve on the gas supply to reduce the total quantity of gas burning on one wall while still keeping the proportional distribution of heat the same.

As none of the manufacturers of the iron employed for the retorts could guarantee that the metal would stand a temperature above 625 deg. Cent., it is essential that the working temperature of the retorts shall be as near this limit as possible, since if it falls below 625 deg. Cent. the "throughput" of the retorts will be reduced and also certain coals have been difficult to work at a lower temperature. In order to provide this necessary check upon the temperature, pyrometers are placed horizontally at three positions in each retort, namely, 3ft. 10in., 9ft. 6in., and 15ft. from the top. These pyrometers are staggered so as to give some indication of the temperature of the two sides of the retort, and they are fixed in holes drilled in the vertical flanges and ribs of the retort. The leads from them are connected to two millivolt meters and to two switchboards—one set for the twenty retorts on each side of the bench. The system of temperature control as originally designed has undergone considerable modification, and finality has not been attained yet in this particular department of management.

The coke extracting gear has also undergone alteration, for, as originally planned, it was operated from the base of the retorts. The disadvantage of this arrangement was that the gear was sometimes left in action longer than necessary and the retort was largely emptied into the coke chamber without addition of any fresh coal from above. In order to have the coke extraction under better control the extraction gear is now operated from the charging platform, and at intervals of one and a half to three hours a portion of the carbonised coal is extracted from the retort and discharged into the coke chamber below it. The usual plan is to remove about 5ft. 6in. of the charge depth at each discharge interval, and this is replaced by fresh coal from a travelling skip through the top valve of the retort.

The gas and oil vapours are led away from the top openings of the retort by take-off pipes to two collecting mains 15in. in diameter, which lead into a 20in. foul gas main. The gas passes then into annular air-cooled condensers with a capacity of 960,000 cubic feet of gas per day, and thence to the gas exhausters and to the usual sequence of apparatus for removing tar, ammonia, and sulphuretted hydrogen.

As regards the raw coal employed for this plant, it is delivered by railway wagons into a jigging feeder, and from this into a 25-ton-per-hour single-roll crusher. The crushed coal is then passed over a ¾in. screen and all coal above this size is employed for feeding the retorts, being stored in an overhead storage bunker of 15 tons per hour capacity. The fine material is delivered to a Yeadon briquetting plant with a capacity of 10 tons of briquettes per hour, and the briquettes, which are of the ovoid type, and about 3 oz. in weight, are delivered by an elevator to a special compartment of the overhead storage bunker.

The low-temperature coke, after remaining some time in the coke chamber at the base of each retort, is discharged into trucks running on rails beneath the retorts. These trucks are then removed to the end of the retort house. Here the container is lifted off the carriage and is transported by automatic telpherage to the grading and screening plant. The carbonised fuel produced at Richmond has been named "Gloco," and at the date of the visit was being sold at 43s. per ton in bags at the consumers' premises. The plant at Richmond consists, as already stated, of two rows or banks of twenty retorts each, but on the occasion of the visit of the members of the Institute of Fuel only twenty-five of the forty retorts were in operation and about two tons of fuel per retort was being produced, or 50 tons per day. It is estimated that in time a plant of this size ought to produce about 70 tons of "Gloco" per day by carbonising 100 tons of raw coal.

Oil Films and Bearings.*

By Monsieur H. BRILLIE and Dr. A. M. ROBB.

THIS paper has as its background the classic work of the late Osborne Reynolds, and a general consideration arising out of that work, namely, the suggestion that the so-called "wedge formation" is not essential to the maintenance of perfect or film lubrication. The idea of the oil wedge, as developed by Mr. Michell, admittedly leads, the authors allow, to effective and highly efficient lubrication, but Monsieur Brillié in extended studies, part of which took the form of a paper read before the Association Technique Maritime in June last, showed that the actual wedge shape is not essential for the actual film, but is necessary only to the formation of a film which, if properly fed, may thereafter maintain itself between parallel surfaces. This general consideration is qualified only by the fact that in an actual bearing the wedge formation is inevitable, owing to the excentricity of the journal in its bearing. In the first part of the paper the methods of calculation used are given, and an expression is developed for giving the actual thickness of the oil film, or the clearance between the shaft and the journal at any given point. The relation of the thickness of the film h, the excentricity e and the mean clearance r is given for a particular case by the expression—

$$h^1 = r\left(1 - \frac{e^2}{r^2}\right).$$

In his general work, Monsieur Brillié has shown that with

* Inst. Naval Architects. Italy, September 18th. Summary.

a wedge-shaped film, such as is formed at a Michell bearing pad, there is a definite relation between the mean thickness of the film and its thickness at the section of maximum pressure. On the assumption that in a bearing the outline of the film may be replaced by two straight lines, as shown at the lower part of Fig. 1 (b), it is shown that the expression developed is strictly applicable for a Michell pad and approximately accurate as a first approximation for an ordinary bearing. Another important equation is that of—

$$\frac{d\,p}{d\,x} = \frac{2\,\lambda\,u}{H^2} \cdot B,$$

in which the quantity B is based on the relation at any point around the circumference between the thickness or clearance at that point and the thickness or clearance at the section of maximum pressure. Hence, it becomes important to determine the section of maximum pressure. The pressure at any point is determined by integrating the equation above given, and in the paper the values so obtained are set out in tabular form. The ratio between the thickness at the chosen angular portion and the thickness at the section of maximum pressure is given, along with values of B. The fundamental equations underlying these values and relations are given in an appendix to the paper. Fig. 2 shows a curve of B, which is a smooth one, making it only necessary to add the mean ordinates for a series of sections of equal length multiplying by the length of the sections. The results of this simple arithmetical process are given in the table already referred to. Fig. 2 shows a curve of p^1 giving the pressure at any point in the bearing, and the value of the total load is given by the method of the polygon of forces illustrated in Fig. 3. A typical pressure curve, one of several given in the paper, is shown in Fig. 4.

The calculation of the frictional resistance is carried out in a similar manner, and different degrees of excentricity are considered, the viscosities, linear velocities and clearance ratios being assumed to have unit values.

For the case of slight excentricity, in other words, under the ordinary operating conditions of bearings, the frictional resistance is, according to the authors, expressed by the formula—

$$F = (100\,\lambda)\,u\,.\,l\,.\,\frac{1}{m}\left[0{\cdot}6 + 0{\cdot}5\left(1 - \frac{n}{m\,.\,R}\right)\right]$$

And since $\left(1 - \frac{n}{m\,R}\right)$ is small, this may be taken as—

$$F = (100\,\lambda)\,u\,.\,l\,.\,\frac{1}{m} \times 0{\cdot}6.$$

The frictional resistance is thus shown to be independent of the excentricity, and is proportional to the velocity u and the length of the bearing, and is inversely proportional to the "clearance coefficient" m.

The work absorbed in resistance is therefore proportional to the length of the bearing and to the square of the circumferential velocity of the journal. This work absorbed is directly proportional to the horse-power absorbed, or to the heat generated.

Hence in high-speed machinery, turbine machinery, for instance, the consideration of the heat generated assumes great importance. It is possible to reduce the amount of heat generated by increasing the value of m, the resistance, and so the amount of heat generated, being inversely proportional to m. But that method of diminishing the heat generation would lead to a journal whose alignment is not sufficiently accurate—a serious consideration in the case of geared turbines, where the accuracy desired is of the order of one-tenth of a millimetre, and sometimes even closer.

General Conclusions.

It is not overlooked that the consideration of the oil film in the paper is very incomplete. No account is taken of the effect of restricted length of bearing on the distribution of pressure along the direction parallel to the axis; the effect of losses of oil from the bearing; the effect of variation of viscosity with increase in temperature of the oil.

The general equations which are developed should be amended or extended to take account of these additional considerations, and so the numerical coefficients should be subject to modification. It is suggested, however, that the character of the equations should not be appreciably altered, and that therefore some practical conclusions may reasonably be drawn from the present partly restricted consideration. These conclusions are outlined below. It is assumed throughout that the load is always vertical and acts downwards.

Complete Film.

Displacement of Journal.—The journal is displaced in the bearing as the result of the viscosity forces in the oil. It is subject to an upward vertical displacement, with a tendency for the journal to have its centre in the same horizontal plane as the centre of the bearing. It is subject also to a horizontal displacement in the direction of motion of the lowest radius; this displacement increases with the load, but it is relatively very small with loads of normal amount. This displacement may have serious consequences in certain cases from the point of view of fitting up the parts of the machinery. It will be discussed at a later stage.

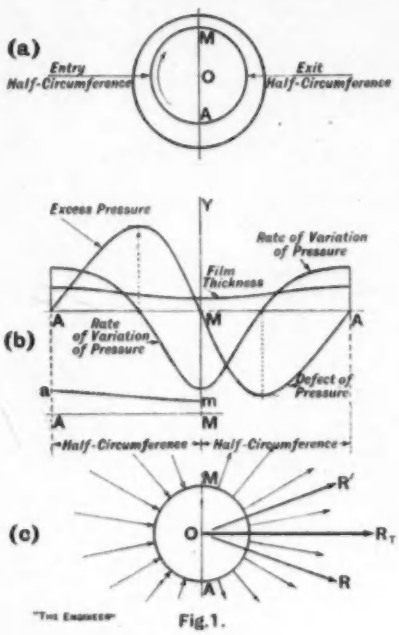


Fig.1.

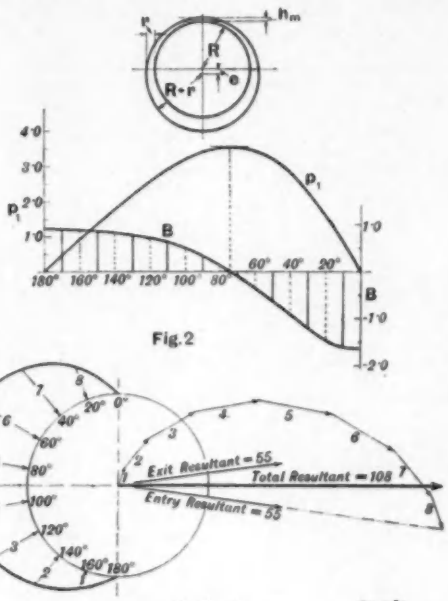


Fig.2

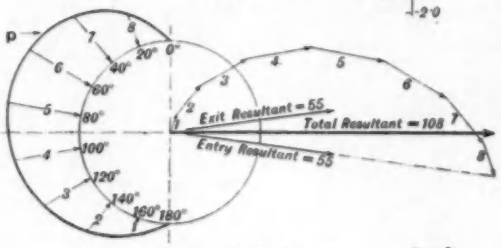


Fig.3

Influence of the "Draw."—The "draw" which is commonly given to bearings in the neighbourhood of the division has the effect of considerably reducing and even of annulling the viscosity forces precisely in the region where these forces have the greatest importance. Altogether, there result:—

(1) A diminution in load-carrying capacity.

(2) A modification in the position of the journal, so that the angular displacement is considerably reduced.

Effect of Temperature.—Increase in the temperature of the oil has the effect of reducing the viscosity forces in the regions of maximum pressure, and produces the same results as "draw," namely, diminution in load-carrying capacity and reduction in angle of displacement of journal.

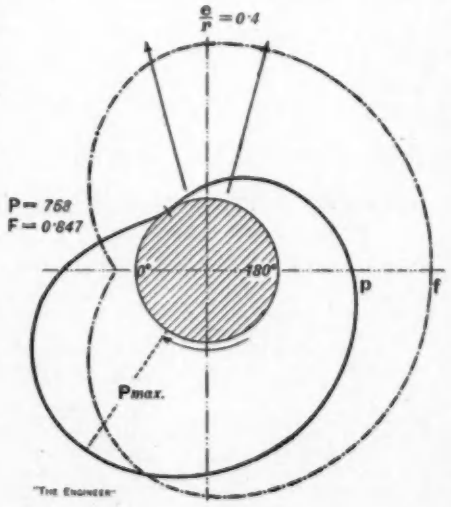


Fig. 4

It should be noted that these two effects are functions of the amount of oil supplied, and so may be variables under working conditions.

Load-carrying Capacity.—From the point of view of load-carrying capacity, it should be noted that, in the case of the complete film, one complete half of the bearing is subject to pressures acting downwards, and therefore in the same direction as the load. It is true that these pressures, being set up by the film over the exit half-circumference, are recovered in the entry region with a useful upward effect; but the oil pressures are on this account appreciably increased, and with them the importance of the question of oil escape.

There should be noted also, particularly for the bearings with the larger values of excentricity and the heavier loadings, the obliquity of the maximum pressures in relation to the load—see Fig. 4. There would, therefore, seem to result a measure of instability of the journal in the bearing, under the effect of accidental variation in the supply of oil, of variation in temperature, and even of accidental variation in the load, such as variable forces arising from the pressures of teeth in gearing. This possible instability must bring in its train vibrations prejudicial to satisfactory operation.

Frictional Resistance.—With the complete film the frictional resistance operates over the whole circumference of the journal, and represents pure loss for about two-thirds of the circumference. As the result of the friction there is a raising of the temperature of the oil, a consequent reduction in viscosity, and so a diminution in the thickness of the film, and, on this account, the possibility of seizing. Also there is a loss of efficiency which may be serious—6 to 8 per cent. of the power of the turbines—if reduced "play" in the bearings be maintained. Alternatively, the "play" may be increased in order to reduce friction, but the reduction is obtained at the expense of quiet and proper working of the machinery.

The frictional resistance has the effect of increasing appreciably the influence of variation in supply of oil on the temperature of the oil and upon the position of the journal in the bearing.

Partial Films.

The various points discussed above for the case of the complete film are discussed below for the case of the partial film.

Displacement of the Journal.—In the case of the "half" film, the displacement of the journal is still more appreciable for the loads of ordinary practice, and represents an angle of 50 deg. to 60 deg., or even more, with the direction of the load. As the film is reduced in length, the displacement is decreased, becoming nearly zero for films of lengths subtending angles of 10 deg. to 20 deg. Hence arises the possibility of greater accuracy in fitting.

Load-carrying Capacity.—For a given thickness of film the load-carrying capacity is much greater than that of the complete film. An explanation of this fact is that, in the shorter films at least, the pressures are altogether less oblique to the direction of the load. From the fact that for a given load the film is thinner arises the necessity for greater care in the fitting of the bearings.

Frictional Resistance.—The frictional resistance is considerably reduced for the partial film, under conditions which, in practice, may represent a reduction in the ratio of one to ten. Hence there follow increase in efficiency, reduction in temperature rise, and possible reduction in amount of oil supplied.

Practical Application.

It follows from the considerations developed above, that it is impossible to reduce resistance, and so the amount of heat generated, by increasing either the diameter or the length of a bearing. It would be necessary, on the contrary, to reduce the length of the bearing surface; but the same end could be reached by increasing the "play," or the ratio—

$$\frac{r}{R} = m.$$

These two solutions are generally inadmissible; on the one hand, because of the weights of the parts supported by the bearings, on the other hand, because of the accuracy of fitting necessary for satisfactory running.

Examination of the curves of pressure distribution in Fig. 4 indicates that outside approximately the bottom one-third of the circumference, the oil in the lower half of the bearing exerts pressures whose vertical components have comparatively low values, and consequently make but small contribution to the resultant force which balances the load of the journal. Examination of the associated curves of resistance shows, on the other hand, that for the upper two-thirds of the bearing the resistance per unit of circumference is very nearly the same as for the effective load-carrying region provided by the bottom one-third of the circumference. Also the unital pressure on the upper portion of the bearing is much less than the unital pressure on the lower portion.

These considerations, based on investigations of the properties of complete films, indicate the desirability of reducing considerably the surface of the upper portion of the bearing.

But when the investigation is extended to the case of the partial film, it is clear that that film offers several advantages over the complete film and that these advantages are especially marked for the films of shorter lengths, subtending angles less than 30 deg. to 40 deg.

It may seem difficult to regulate the supply of oil to a film, so as to give it a predetermined length. It is, however, very easy to adopt forms for the bearings which will ensure working conditions similar to those which give the most efficient films.

Taking first the case of a bearing whose loading is constant in amount and in direction it is sufficient to arrange the bearing surface of the extent considered necessary for the formation of the film, to arrange a "nozzle" of proper shape upstream from the bearing surface, and upstream from the "nozzle" an oil reservoir, surrounding the journal, into which the oil will be discharged downstream. The edges of the reservoir are bounded by circumferential "bands," leaving minimum "play" between journal and bearings in way of these bands. These bands may, in addition, be provided with "basins," arranged close together, in such a way as to ensure the formation of oil films on the "bands" in the event of the journal coming down on the bearing and tending to "seize." The necessity of arranging these "basins," as indicated by practical results, is shown in a paper read to the Association Technique Maritime in June, 1929.

The "bands" may have complete circumferential channels arranged close to the outer edges. These, being filled with oil, will retain, by virtue of viscosity, the oil which otherwise would escape from the bearing.

For bearings whose loading is subject to variation in direction and in amount it is possible to ensure that any change in the working conditions will be accompanied immediately by the formation of an oil film if "basins," sufficiently close together, forming reservoirs of oil are connected by appropriate nozzles with bearing surfaces of chosen extent.

In this connection it is interesting to note that the axle-

boxes of railway trucks, with an axle diameter generally about 13 cm., and a bearing length of about 12 cm., carry loads of 7 to 8 tons. Such a load represents a pressure of about 50 kilos. per square centimetre on the projected surface of the bearing. The effective bearing surface extends for about 3 cm. to 4 cm. round the circumference, so that the pressure in the oil film is actually more than 150 kilos. per square centimetre. The oil film maintains itself under that pressure, at least partially, since the coefficient of friction is in the region of 0·008. It is therefore certain that in bearings of marine engines, where the unital pressure is very considerably lower than in the instance given, a length of about 2 cm. between "basins" should be quite sufficient to ensure that an oil film of adequate bearing capacity will be formed, even on the assumption that the single film between two "basins" may be required to carry the whole load.

All the theoretical considerations point, therefore, to the adoption of "basins" connected with appropriate "nozzles" and separated by surfaces 2 cm. to 5 cm. in length. Each surface between the "basins" should in normal working conditions form a boundary of a perfect film of oil.

It may be advantageous also to form an oil reservoir in the central region of the bearing, the breadth of the reservoir being greater or less according to circumstance. This reservoir will, in the case of a change in the direction of the load, facilitate the flow of oil from the initial bearing region to the subsequent bearing region. It will facilitate also the supply of oil to the various "basins," and may, from this point of view, be arranged even in the actual load-carrying region of a bearing with constant loading.

Over and above the theoretical consideration is the fact that in a large number of ships of the Cie Générale Transatlantique various bearings in the machinery have been altered in accordance with the general theory of which a particular application has been discussed above, and the alterations have invariably resulted in considerable reductions, and sometimes complete elimination, of the wear on the metal, and have permitted the doing away with the water-cooling arrangements. It is a reasonable deduction from ascertained facts that, in plummer blocks as in thrust blocks, perfect films of oil have been formed, with the load borne entirely on the oil.

Suggested New Arrangement of Turbine Bearings.

An outline of a bearing for turbine machinery, based on the considerations discussed above, is shown in Fig. 5.

The lower portion of the bearing is the effective load-carrying region. It is formed by a circular surface having a radius slightly greater than that of the journal. In it

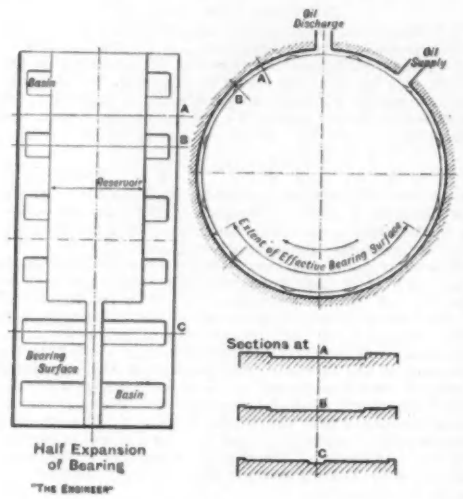


Fig. 5

are shown the "basins" whose purpose has been discussed above, also a central connecting channel which ensures the circulation, and so assists in the cooling, of the oil.

The upper portion of the bearing contains a reservoir bounded by "bands," which restrict the "play" of the journal and provide bearing surface against the contingency of actual contact. In short, the illustration embodies all the features whose desirability has been indicated from theoretical considerations, and whose effectiveness has been demonstrated in actual practice. The one omission from the diagram is the circumferential channels in the bands, an omission explained by the difficulty of reproduction on a small scale.

It follows from the various theoretical considerations that, leaving out of account meantime the "basins," the resistances of bearings of the ordinary type and the suggested type are closely in relation to the bearing surfaces. With the suggested type of bearing the surface is only about 60 per cent. of that in the ordinary type. When the "basins" are taken into account, there is a further reduction of surface with the new type of bearing. The "basins" amount to about 30 per cent. of the gross area of the surface. Hence the suggested arrangement should result in reducing by more than one-half the resistance, and so the amount of heat generated. There should therefore be an appreciable reduction in the temperature of the bearing.

It is interesting also to note that the investigation into the qualities of bearings with complete oil films leads to the conclusion that per centimetre of length of bearing, and assuming the normal amount of "play" representing, round the journal, a clearance of one-thousandth part of the radius, the resistance for a velocity of 1 m. per second amounts to 0·6 kilos., assuming the coefficient of viscosity to be 1×10^{-3}, representing an oil temperature of about 35 deg. Cent. Taking the case of a turbine bearing for high power, with a circumferential velocity of 30 m. per second, the figure rises to 18 kilos. and to 360 kilos. for a bearing whose length is 20 cm. Hence the work done per second is 360 kilos. × 30 m. = 10,800 kilogrammetres. This amount of work represents about 140 I.H.P., and corresponds to a heat generation of 20 calories per second.

If it be noted that in the machinery installation of a very large and fast Atlantic liner there may be five plummer blocks per turbine, say, fifteen plummer blocks per line of shafting, and sixty plummer blocks in all, the total horse-power absorbed in these bearings may exceed 8000, amounting to 5 or 6 per cent. of the total power of the installation.

That figure indicates the importance which should be attached to a new arrangement which leads to reductions in working temperatures of bearings, thus increasing the assurance of satisfactory operation, while increasing to an appreciable extent the efficiency of the installation, and by virtue of the possibility of adopting reduced clearances tends to the elimination of wear of gearing, and so to the elimination of noise and vibration.

Some Service Results.

Some interesting service results have been obtained on the French line steamship "Puerto Rico," now the "McKnes." This vessel was built about fifteen years ago for the company's service between St. Nazaire and Haiti, but recently transferred to the service between Bordeaux and Casablanca. In the new service an increase of speed was required. During her trials she attained nearly 18 knots at 95 engine revolutions for a four-hour period only, and at light draught and with forced firing. In actual service only 12 or 13 knots was obtained, and in order to get the 15 to 16 knots necessary, it was decided to install two additional oil-fired boilers and an exhaust turbine working on the Bauer-Wach principle, in conjunction with the reciprocating engines. It was decided to do away entirely with the old system of lubrication and to replace it by basins of the type described in the paper, which were applied to all the engine bearings. The machinery ran perfectly satisfactorily after this was done, and with the water cooling cut-out there was no heating of the bearings or knocking at any speeds. At 109 to 117 revolutions a ship's speed of 16 knots was attained. When the exhaust turbine was put in a Michell thrust bearing was also added, and by fitting a torsion-meter it was possible to measure the mechanical efficiency of the bearings and the Michell thrust. The exhaust turbine was cut out and with the engines running at 98 revolutions, corresponding to an output of 1800 H.P., or 70 per cent. of the full rating, the mechanical efficiency was found to be 0·91. It was estimated that with ordinary methods of lubrication an efficiency of 82 to 85 per cent. would be normal, and the actual gain of 7 or 8 per cent. seemed to be in accordance with the theoretical results.

A further experiment was made with regard to the calculation of the frictional loss in the ten bearings of the exhaust turbine, and double-reduction gearing by applying the formula given in the paper. The power taken at 110 revolutions worked out at 234 H.P. As the oil was supplied from a single pump, it was possible to check the quantity per second which was 9·45 litres. By measuring the rise in temperature, the power taken by the ten bearings and thrust blocks was calculated at 234 H.P. In the theoretical calculation above referred to, the two thrust blocks were not taken into account. It must also be borne in mind that some heat is given up directly to the bearings by the steam. In the actual experiment, the rise in temperature between the oil inlet and outlet was 20 deg. Cent., which, with an oil flow of 9·45 litres per second, represented 321 H.P. instead of the 234 H.P. calculated. When the two factors above mentioned, however, were taken fully into account, it is considered that there was little difference between the calculated figure and that obtained from the experiments. The results are of interest as demonstrating the considerable loss of power which may take place in turbine bearings. The direct consequences of this loss are heating and reduced efficiency, with the necessity for larger clearances which brings vibration and noise. The experimental results would seem to indicate that a gain of 5 or 6 per cent., or even more, in power can be obtained with the new arrangement of bearing lubrication.

Canadian Engineering News.

(From our own Correspondent.)

Rapid Progress in Hydro-Electrics.

In the first six months of the current year new hydro-electric developments, together with additions to existing plants, have added almost 200,000 horse-power to the total installation in the Dominion, while undertakings are under way which, when completed to their designed capacities, will involve a total installation in excess of 2,000,000 horse-power.

The outstanding developments are in the provinces of Ontario and Quebec. In Ontario, the provincial Hydro-Electric Commission has in hand the addition of the tenth unit of 58,000 horse-power capacity to its Queenston station on the Niagara River. Work has also been resumed on the 54,000 horse-power plant at Alexander Landing, on the Nipigon River, which will be completed in 1931. Construction was recently completed of the Ear Falls storage and power dam at the outlet of Lac Seul, on the English River. An installation of 5000 horse-power is now being proceeded with at this dam for the supply of the nearby Red Lake mining district. In Northern Ontario two new developments have recently been completed: one of 28,200 horse-power for the International Nickel Company of Canada at Big Eddy Dam, on the Spanish River, and the other for the Algoma District Power Company at High Falls, on the Michipicoten River. The latter has an initial capacity of 18,770 horse-power.

Installations already completed during the present year in the province of Quebec include the addition of the fourth units to the Chelsea and Farmers Rapids developments of the Gatineau Power Company on the Gatineau River of 34,000 horse-power and 24,000 horse-power respectively; and of the second unit of 25,000 horse-power at the Gatineau Company's Bryson development, on the Ottawa River; the addition of unit No. 8 of 43,000 horse-power to the Shawinigan Falls development of the Shawinigan Water and Power Company. Construction is also being actively pursued on several large developments. At Chute-à-Caron, on the Saguenay River, the Alcoa Power Company is making rapid progress with a development which will have an initial installation of four 65,000 horse-power units scheduled for completion in 1931. The ultimate development is designed for an installation of 1,000,000 horse-power. On des Prairies River, near Montreal, the Montreal Island Power Company has work well advanced on a development which will have an initial installation of six 8800 horse-power units, and which it is expected will be in operation late in the present year. The James McLaren Company has a development actively under construction at High Falls on the Lievre River which is designed for an initial installation of 90,000 horse-power and an ultimate capacity of 120,000 horse-power. The Gatineau Power Company has nearly completed a dam at the outlet of Cabonga Lake at the headwaters of the Gene-de-Terre River which will impound 45,000 million cubic feet of water for the benefit of the company's power stations on the Lower Gatineau River.

Unprecedented development is also taking place in British Columbia and in the Maritime Provinces, and plans call for the expenditure of many millions of dollars on hydraulic projects during the next four or five years.

Proposed Bridge Across Halifax Harbour.

Plans and specifications have been submitted to the Department of Public Works at Ottawa for a projected bridge across Halifax Harbour linking Halifax and Dartmouth. This undertaking has been actively supported for a number of years, and the Halifax–Dartmouth Bridge Company has been incorporated with a view to carrying out the enterprise. Technical and legal preliminaries, it is stated, have now been almost completed. The proposal is that the viaduct be built at the Narrows, where the shores of the harbour proper converge to the channel that leads into Bedford basin. A 150ft. clearance above high water is provided for in the plans giving ample room for ships, while the centre span would be 960ft. between the main piers. At present the harbour is crossed by ferry or by the highway skirting Bedford basin. The bridge would cut about twenty miles off the highway to Dartmouth and south-east coast points.

Exports of Metals from Canada in June.

A feature of Canada's exports of non-ferrous ores and smelter products in June was a large increase in the shipments of aluminium. The report of the Dominion Bureau of Statistics gives the amount exported in blocks, &c., during the month as 13,531,300 lb., valued at 2,366,701 dollars, compared with only 2,224,600 lb., worth 422,198 dollars, in May, and 5,882,000 lb., valued at 1,153,833 dollars, in June of a year ago. Exports of copper in ore, matte, regulus, &c., totalled 7,263,700 lb., valued at 735,945 dollars, and blister copper, 11,987,400 lb., worth 2,141,252 dollars, a total of 19,251,100 lb., valued at 2,877,197 dollars. These figures represent a slight decrease from May, when 20,513,300 lb., worth 3,134,181 dollars, were exported, but a large increase over June, 1928, when Canada's exports of copper totalled 13,601,000 lb., worth 1,698,268 dollars. Exports of nickel of all grades during June totalled 11,846,600 lb., valued at 2,627,486 dollars, compared with 9,192,000 lb., worth 2,119,296 dollars, in May, and 7,163,600 lb., valued at 1,655,775 dollars, in June of last year.

Plans for Great Fertiliser Industry.

The Consolidated Mining and Smelting Company of Canada has announced plans for the building up of a great fertiliser industry at Trail, British Columbia. The company proposes to spend approximately 7,000,000 million dollars in the next two years for the accomplishment of the joint objective of establishing a huge chemical fertiliser industry and of removing from smelter gases their deleterious element. A large number of plants are to be erected for different parts of the industry, which will make new demands for about 30,000 horse-power of electrical energy. The first unit, it is stated, will produce 35 long tons of fixed nitrogen per day, which means approximately 175 long tons of ammonium sulphate or alternatively 260 tons a day of ammonium phosphate. An electrolytic hydrogen plant will account for 23,000 horse-power of the 30,000 horse-power initially required for the fertiliser works. There will be a liquid air plant for extracting pure nitrogen from the air. A synthetic ammonia plant will transform the nitrogen and hydrogen gases from the two plants into anhydrous ammonia. The plans for the utilisation of smelter fumes involve the manufacture of over 300 tons daily of sulphuric acid by the contact process, which will take the sulphur dioxide from the roaster gases and convert it into acid. The company already has a 35-ton sulphuric acid plant which has been working off these gases since January and has proved satisfactory. The sulphuric acid plant will be built in conjunction with the metallurgical works. The site for the remainder of the new fertiliser industry on a flat above the smelter is to be so arranged that the plant can be extended to ten times the size of its initial unit. It is expected that the whole of the first unit will be in operation within two years.

Record Iron and Steel Output.

Canada's iron and steel production continues to grow at a rapid rate, the figures providing irrefutable evidence that consumption of iron and steel is at a peak in the Dominion. With the exception of the war year, 1917, when conditions were abnormal, Canada made more pig iron in the first six months of this year than ever before in a similar period in its history. Steel production in the same six months was 14 per cent. over that of the first half of 1928, and 52 per cent. greater than the 1927 figure. Preliminary statements would seem to indicate, too, that this business is being produced at a greater profit than in recent years. Railway requirements have contributed notably to the general prosperity of iron and steel and allied interests. Orders placed by the Canadian railways for locomotives and goods and passenger vehicles in the first eight months of the year are estimated at approximately 75,000,000 dollars. This has meant great activity among railway equipment companies and many allied lines, and in itself has proved a splendid stimulus to business.

Railway and Road Matters.

There was a collision between a passenger train and a goods train at Tottenham North Junction on Friday, October 4th.

A plant for the kiln drying of timber, of the Sturtevant type, is to be put up by the East Indian Railway. It is to have a capacity of 3000 tons of converted timber a year.

According to a description of the Harwich-Zeebrugge train ferry, given in the *Railway Newsletter* for October, the tonnage carried in 1925 was 86,666 tons; in 1926 it was 145,819 tons and rose to 156,320 tons in 1927.

The London, Midland and Scottish Railway is interested in a scheme with which the Aire and Calder Navigation is associated, for dock developments at Goole, which are to cost about £110,000. Goole is the only port on the East Coast possessed by that railway company.

Owing probably to coal workings, the tunnel on the former North Staffordshire Railway between Newcastle Junction and Newcastle-under-Lyme Station has become distorted. It is to be re-lined, and for that purpose will be closed on Saturday nights. The work will occupy about three months.

According to the report of the Indian Railway Board, investigations have been continued, with the collaboration of the staff of the Forest Research Institute at Dehra Dun, into the possibilities of the increased use of various indigenous timbers for sleepers and for coach building. Much useful work has been done, and more can be done, but some years must elapse before definite conclusions can be obtained as to the suitability of all the various species now being tried.

Of the 98,709 steam-worked trains on the Southern Railway during the month of July last, 61·22 per cent. arrived on time, and of the remaining 38·78 per cent. 26·26 per cent. were not more than five minutes late. Of the 90,606 electric trains, 73·81 per cent. were punctual, and 23·24 per cent. of the other 26·19 per cent. were not more than five minutes late. Of greater importance, as indicating operating efficiency, 61·7 per cent. of the 16,992 freight trains arrived on time.

It will be remembered that in 1926 the London, Midland and Scottish and the London and North-Eastern companies presented separate Bills in Parliament for railways in Mid-Nottinghamshire to serve the colliery developments in that neighbourhood. Parliament rejected both Bills and advised the companies to join forces and promote a jointly-owned railway. That was done in 1927, and the necessary powers were sanctioned. It is now officially announced that the work will shortly be begun. The line will be eight miles long and will be administered by a joint committee of both companies.

The Ministry of Transport railway statistics for June last give also the results for the first half of the year. They show that, compared with the January–June period of 1928, an increase of 2·3 per cent. in the number of passenger journeys but a decrease of 4·5 per cent. in the receipts from passengers and of 3·5 per cent. in passenger traffic receipts. Passenger train miles increased by 1·9 per cent. The tonnage of freight traffic increased by 5·3 per cent.—merchandise fell by 0·8 per cent., but coal and coke rose by 8·5 per cent. Freight traffic receipts increased by 2·0 per cent. owing to a rise of 8·9 per cent. in coal traffic. Freight train mileage increased by 1·8 per cent.

When the Institution of Railway Signal Engineers visited Holland in June last, the members were surprised to find that, as in Belgium and Switzerland, all the points are activated by double wires—an outward and a return. Such a method of operation has never found favour in this country; points were, until the 'eighties, worked by wire on the Midland, but by a single wire. What deterred the companies—or was used as an excuse for inaction—was that the Board of Trade requirements for new railways ordered that all points should be worked by rods. Thanks to the enterprise of the Westinghouse Brake and Saxby Signal Company, interest in wire-working has been aroused in this country, and trial installations have been put down in the Southern area of the London and North-Eastern and on the Midland section of the London, Midland and Scottish Railways. Now the *Great Western Railway Magazine* announces that that company has fitted double-wire working to some points at Park Junction, Newport. As they are 600 yards from the box the installation is presumably on a goods line.

On July 19th last a passenger train stood at the home signal for the down fast line at Ardwick Junction, Manchester, London, Midland and Scottish Railway, when it was run into in the rear by a light engine which had come from Longsight engine shed, and had been allowed, irregularly, to enter the section by the signalman at Longsight No. 4 box. How that came about is a very interesting story. When the passenger train had arrived at Ardwick Junction the fireman, instead of going to the signal-box, in accordance with rule 55, to remind the signalman that his train was there, went to the fireman's call box and pressed the plunger there, which actuated a "train waiting" indicator in the signal-box and turned the needle of the down fast line instrument to *train-on-line*, which also was recorded on the corresponding instrument in Longsight No. 4 box. The sequel to that movement was that the man in the latter box got confused, just after, by other trains and telephone calls, and seeing the down fast instrument at *train-on-line* he assumed that he had asked for and had received *line clear* for the light engine, and that he had then signalled *train-on-line* for it, and that was why the instrument stood as it did. He thereupon lowered his starting signal and the collision resulted. In reporting on the accident Lieut.-Colonel Anderson says that "It must be recognised that whatever elaboration of electrical interlocking apparatus is provided, reliance must still be placed on careful and correct operation by signalmen to insure safety, and such reliance is well justified in practice." The report proceeds to observe that "there must always be risk of human failure in busy signal-boxes controlling two or more lines in each direction, especially at junctions, and any apparatus which tends to reduce such risk, as, for instance, by reducing the mental strain on the signalman, must be advantageous.

Notes and Memoranda.

An etching solution mentioned by Mr. A. B. Kinzel at the National Metal Congress held at Cleveland, U.S.A., comprises absolute alcohol with enough water to hold copper sulphate and copper chloride in solution, and slightly acid.

Blue powder containing 4 and up to 8 per cent. of cadmium has been the main source of cadmium in Europe. This powder and likewise the cadmium-bearing fumes are mixed with carbon and treated by repeated distillation for the recovery of their zinc and cadmium.

A chemically pure iron, possessing magnetic properties, that may be used for the smaller kinds of electrical machinery, was described by Dr. T. D. Yensen, of the Westinghouse Electrical and Manufacturing Company at a meeting of the American Electro-chemical Society at Pittsburg.

In order to test a steel sphere for the conveyance of helium in America, it was loaded on a flat railway wagon, between two 7½-ton steel cylinders, and the wagon was then shunted over the end of an embankment 25ft. high. It was not damaged. The sphere was 6ft. in diameter and made of two 1¼in. plates electrically welded together. It required a pressure of 4500 lb. to burst it.

The penstock of the Big Creek, 2A plant of the Southern California Edison Company, which will work under a head of 2418ft., and provide water for two units of 56,000 horse-power each, will comprise 1858ft. of quadruple-riveted pipe varying from 108in. to 84in. in diameter, and from ⅞in. to 1⅛ in. in thickness; 3042ft. of banded forge-welded pipe varying from 84in. to 66in. in diameter with a thickness of 1⅛in. to 2½in.; 1764ft. of seamless forged pipe, practically all 66in. in diameter, with thickness varying from 2¼in. to 3in.

In commenting on the explosion of a water gauge connection on board a steam trawler, the Engineer Surveyor-in-Chief, Board of Trade, says: "This case emphasises the necessity for providing means for shutting off at the boiler all pipes connected to the boiler, as without such provision the position may become serious if a pipe fails. A satisfactory temporary repair could no doubt have been made in this case if such fittings had been provided. The renewal of the pipe proved to be necessary as internal pitting, which caused the failure, was subsequently observed at other parts in the old pipe."

The Cologne–Rheinau (Mannheim) section of the 220-kV overhead transmission line built in 1926 by the Rheinisch-Westfalische Elektricitäts-Werk of Essen, has up to the present been operated at 110 kV. Work is now in progress to extend the line as far as the Vorarlberg, and at the same time to operate it at 220 kV. The line is to be completed in 1930. The contract for the complete equipment for seven transformer stations for 220/110 kV has been placed and the stations are to be of the outdoor type. The 60,000-kVA transformers are arranged for compressed air circulation of the cooling oil. The weight of each transformer, without cooling apparatus, is about 180 tons. Since the neutral point of the 220 kV will not be earthed, the insulation must be provided for the full 220 kV.

A world's record for production by a blast-furnace with a 13ft. 9in. hearth, is claimed for No. 1 furnace at the Sixth-street plant of the Ashland, Ky. division of the American Rolling Mill Company. This furnace has just completed seven years of continuous operation, which record, it is said, has been equalled or surpassed by only one other furnace. While it has been surpassed in endurance, it has achieved a better production record than any other furnace with a 13ft. 9in. hearth. The old lining contained 224,000 9in. bricks. During the seven years of continuous operation with this lining, there were 809,951 tons of pig iron produced or an average of 3·6158 tons per 9in. brick equivalent. The best previous record, made by another furnace, was 3·41 tons. No. 1 has made other creditable records, as follow:—Day output, 454·82 tons; weekly output, 2844·82 tons; monthly output, 12,083·52 tons; daily average output, 393·10 tons; pounds of coke per ton of pig iron, 1538.

As a fluxing material in soldering rustless steels, a mixture of borax and boracic acid has, according to *Die Metallbörse*, proved satisfactory. Mention may also be made of a flux for soldering carbon-steel alloys developed by the I.G. Farbenwerke, which has proved to be quite satisfactory. It is composed of metals and metalloid acids, the basic material of which will alloy with iron. Particularly advantageous are compounds, such as titanium hydroxide, phosphorus-molybdic acid, and aluminium molybdate, in combination with a ground powder of a suitable viscosity and surface tension at the usual soldering temperatures. As the soldering metal a suitable copper alloy can be used. A fluxing mixture which has been found suitable for use with such soldering alloys has the following composition:—45 per cent. of an alkaline borate, 25 per cent. of an alkaline carbonate, 25 per cent. of an alkaline chloride, and 5 per cent. titanium hydroxide. Instead of titanium hydroxide, phosphorus-molybdic acid or ammonium-molybdic acid, or both, may be employed.

A plan for the conversion into gaseous fuel of cornstalks, making possible the lighting and heating of farm homes, was presented in a paper read before a recent meeting of the American Chemical Society by A. M. Buswell and C. S. Boruff, of the University of Illinois. The suggested procedure, according the the *Engineering News-Record*, involves the collection of the stalks in a closed fermentation tank into which are led the household wastes. The latter provides the necessary nitrogeneous materials for the bacteria bringing about the fermentation of the cornstalks, with the result that a gaseous mixture of carbon dioxide and methane, or marsh gas, is obtained, equal in heat content to ordinary gas. It is stated that enough gas to supply the needs of a family of four or five can be obtained from a tank 8ft. in diameter and 8ft. deep, as about 50 per cent. of the weight of the cornstalks are converted into gas. The authors of the paper estimate that the usual gas supply for a city of 80,000 can be obtained from a circle of farm land eight miles in diameter. After the gas has been obtained, the fibrous residue in the tank can be used in the manufacture of paper.

Miscellanea.

It is proposed to provide the Kolar goldfield, Mysore, with a proper supply of potable water.

The new power plant at Umtali, Rhodesia, has progressed to the extent of laying down the foundations.

A dam is to be constructed across the river Arkavati, 20 miles from Bangalore, by the Government of Madras.

Asbestos with a fibre length of from 3in. to 5in. is being mined by the Kalkraus Asbestos Company, South Africa.

Dr. David Draper, one of the pioneers of the South African diamond industry, died on September 9th in his eighty-first year.

The exploration of the district in the neighbourhood of Riverhurst, on the South Saskatchewan River, for its possible bearing of natural gas, is to be undertaken on an extensive scale.

A new bridge and roadway on the Great North-road at Cockburnspath, between Berwick and Edinburgh, which involved an outlay of over £20,000, has been formally opened for traffic.

Pursuant to various agreements between the Shanghai Municipal Council and the American and Foreign Power Company, Inc., and the Shanghai Power Company, signed on August 8th, 1929, the Shanghai Power Company has acquired the business of the Shanghai Municipal Electricity Department.

At a meeting of the Finance Committee of the North-East Coast Exhibition at Newcastle on September 26th, the Chairman, Sir William Noble, said that the Exhibition had repaid all but £8000 of the £108,000 of its initial indebtedness to the Corporation and General Securities, Ltd. It was almost certain that there would be a profit on the Exhibition.

The Visapur Lake and Canal, on the Hanga River, India, has been formally opened. The lake, which has a water spread of 2½ square miles, is formed by an earthen dam, 7400ft. in length, with its crest 84ft. above the river bed. The dam is designed to store 1218 million cubic feet, of which 1136 million cubic feet will be available for the irrigation of 13,000 acres of land.

According to the *Ironmonger*, a bell which has hung for nearly 450 years in the tower of Heytesbury Church, near Warminster, Wiltshire, has arrived with five others comprising the peal, at the Bell Foundry of Mears and Stainbank, of 32, Whitechapel-road, London, E. 1, where it will be re-cast and re-tuned. The bell weighs a ton, and is believed to have been cast by a founder named Kebyll about 1480. It is a particularly clean example of the founder's craft of that day, and has two enormous canons or hanging loops.

Important developments have recently taken place at the Mill Close lead mines, near Matlock, which for over a century have produced one-third of the total output of lead ore in the British Isles. Some twelve months ago the old underground workings were reported to be worked out, and it was necessary to suspend about 400 workers. Explorations have, however, been carried out, with the result that ore of a rich character was discovered below water level. A cavity has been cut, over 100ft. below the level of the water, into the newly found deposit, and pumps, which are dealing with 30,000,000 gallons of water per week, have been installed. All the men are now fully employed, the mines are working night and day, and the present output of ore is 150 tons per week, which is 50 tons above the best average in the past century.

Valuable research work in studying fire-damp and coal dust explosions has, says the *Iron and Coal Trades Review*, been carried out by the German Mines Research Company in the Hibernia mine at Gelsenkirchen during the past year. Until 1927 the Hibernia mine was producing 1200 tons of coal daily. Then it was closed down until the Research Company, a scientific company founded and supported by the Federal Government, the Prussian State and the mining interests, acquired it in 1928 for experimental purposes. Elaborate arrangements have been made in the workings to study explosions under natural conditions at close quarters. These explosions are photographed and filmed. At different points blasting positions have been constructed where the effects of the sparks and flames under varying circumstances can be observed. The mine shafts and workings are completely equipped and are in working order, but coal is neither hewn nor wound except when an experiment requires that that should be done.

There is likelihood of an early start being made on an important scheme at Hull for filling in the old Queen's Dock, and thus providing a valuable area of land for the laying out of new streets, and possibly markets and boulevards. The scheme has been afoot for some months, and at first it was hoped that the Corporation would be able to obtain the dock from the L.N.E.R. Company in exchange for an area of land on the Humber foreshore, known as the Western Reservation. The railway company, however, does not desire that land, and it is therefore now proposed that the dock shall be purchased from it. A special committee of the Corporation has drawn up a provisional agreement—which the Council is recommended to confirm—for the purchase of the dock for £117,000. The filling in of the dock would obviate the necessity for a Whitefriargate Bridge. The special committee states that the work of filling in the water space will occupy four years, "so that any scheme for developing the estate cannot mature in the immediate future, but when it becomes a reality it will have done much to relieve the very heavy traffic problem which has become a matter of great public concern during the past few years." In connection with the provision of work for the unemployed, the Town Planning Committee of Hull Corporation has approved schemes involving an estimated cost of £320,000. The construction of a ring road from Gillshill-road to Inglemire-lane, and the widening of Beverley-road, are included. A grant of 60 per cent. of the total cost by the Government is expected. The schemes have been sanctioned by the Ministry of Transport, and an early start with the work is anticipated.

THE SLACKS VALLEY POWER STATION OF THE OLDHAM CORPORATION

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(*For description see page* 390).

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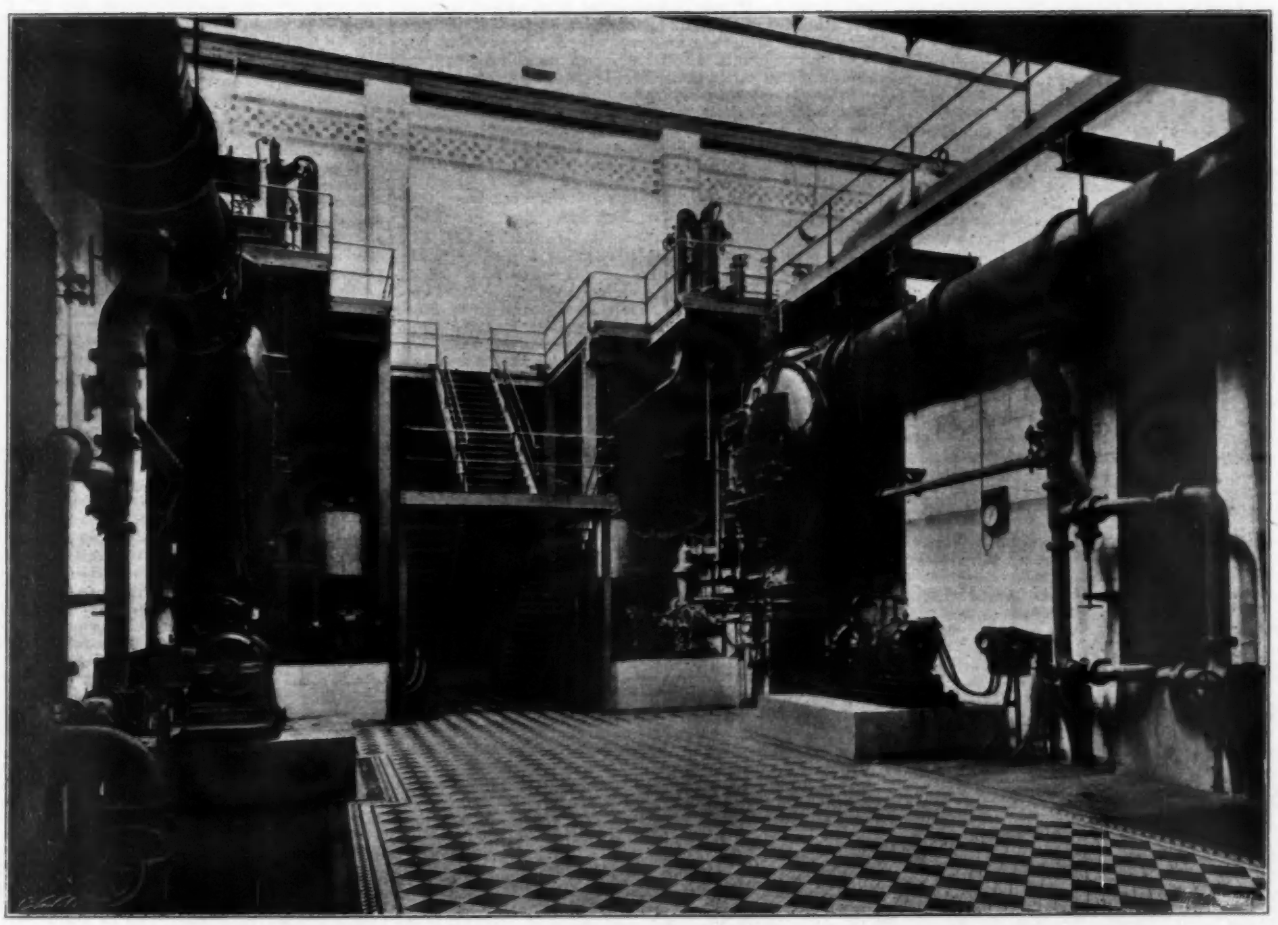

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THE ENGINEER.

OCTOBER 11, 1929.

The Price of Progress.

IN general, when a remark is made as to the costliness of progress, it has reference to the large sums which have to be expended in developing some improved machine or process before any return on the money can be expected. Expense of this nature becomes relatively more and more formidable as the product in question becomes more perfect, until further improvement is rendered practically impossible by the law of diminishing returns. At this point evolution has to stop, to start again before long in a quite different direction. The history of engineering is largely a story of the supersession of perfected types. The sailing ship, as exemplified by the ocean clippers of seventy or eighty years ago, had evolved to a state of beauty and efficiency which seemed insurpassable when it had to give way before the crude beginnings of steam propulsion. On land the fine old beam engines which the labours of a generation or two of engineers had brought to the limits of their power and efficiency disappeared before the Corliss and other direct-acting engines, and these, after having been perfected in their turn, have now been almost swept out of existence by the turbine. To the onlooker such happenings may seem mere incidents in the march of progress, no more to be regretted than the disappearance of the Icthyosaurus and the Pterodactyl from the world when their term was accomplished. But to those adversely affected by the changes, whose interest in life and whose means of living are bound up in an existing order of things, the aspect is different. It is easy to reproach them with undue conservatism and a repugnance to new ideas. They may be conservative, but in so far as their desire is to conserve what they can of the personal and national wealth represented by the accumulated knowledge, experience and material resources which are in danger of becoming valueless, their attitude is far from blameworthy. It is this destruction of wealth which is one of the chief causes of the costliness of progress, for when skill and tools are rendered useless the industry, and therefore the community, have incurred a loss which may be many times greater than the money spent on developing the invention that made them useless. That the invention, all things considered, will result in an increase of the wealth of those concerned may be taken for granted. Otherwise it could not succeed in displacing previous practice. It is therefore to be welcomed as conferring a net benefit on the community, disastrous as may be its effects to individuals or firms.

This conclusion appears logical, and since old practices are constantly being superseded by new ones, it would appear to be justified by facts. Nevertheless there is abundant evidence of opposition to new developments. The instinct of self-preservation is older and stronger than logic, and there are those who would say it is often a safer guide. A firm engaged in the manufacture of a speciality with works equipped and staff trained to that end cannot be expected to welcome the appearance of anything which will destroy the values, material and intellectual, accumulated through many years. Even should the invention be of the firm's own making, the question of whether to develop it at once or to keep it secret till force of circumstances compels its utilisation may well be answered in favour of the latter course. The same spirit of self-preservation prompts the acquisition of rival designs and the purchase of patents with the intention rather of suppressing them than of using them effectively. One can dispraise all attempts to check progress as unethical, short-sighted and fatal in the long run, as well they may be. But at the same time one can understand them. The price of progress is considered too great, especially as it has to be paid almost entirely by firms which have laid themselves out to serve the industry by methods which a new practice would render obsolete. It is they who are threatened with the closing down of whole departments, if not of the entire works; the dismissal of staff and workmen who have served them well, and the competition with rivals who start unencumbered by a heritage of capital charges for which the assets have disappeared. "The toad beneath the harrow knows, Exactly where each tooth-point goes," and the threatened creature is proverbially disinclined to listen to the preachings of the butterfly who suffers no such disadvantages. Even should the industry be the practical monopoly of a single company or group of associated companies, the introduction of changes in design will still cause a serious destruction of values. In this case, however, the cost of progress may be passed on to the consumer by transferring the charges to the new product. This is perhaps the fairest way in which the adjustment of industry to the new conditions may be brought about, for the consumer reaps the advantages of progress while bearing, as he should, the costs incidental to the benefit he receives. There is, nevertheless, the obvious disadvantage that under monopoly conditions the improvement may never be introduced at all. The monopolist firm is tempted to ask itself why it should go to the trouble and expense of developing novelties. Its customers are reasonably well satisfied with existing products and they have no means of getting anything better elsewhere. The spur of competition is absent, so that, unless the new improvement is so important that the obsolescence of plant it will cause amongst users will create a demand sufficient to compensate the firm for the expense incurred by the change of design, it may be thought wiser to continue to supply only the old pattern. In this event the invention is still-born and the benefits which industry would have received from it are deferred until the need of progress becomes too imperative to be withstood. Whether monopolistic industrial organisations make for technical progress is an open question. On the one hand, they have the enormous resources which permit of experimental work forbidden to smaller firms for financial reasons. On the other, they have the secure market which makes for self-content, and the unwieldiness of structure which so often cramps initiative by its mere inertia. Directed, as they almost inevitably are, by financiers rather than technical men, the term "per cent." is considered rather with reference to dividends than to efficiencies. The fact is merely noted, not complained of. All the technical efficiency in the world is useless unless it can earn sufficient profit to pay for itself and leave something over. And since profits after all are the object of every commercial enterprise, the directors are hardly to be blamed if they seek them in the easiest way. Should this be by the maintenance of the *status quo* in design, the policy is one which must be judged by results. Clearly it is a risky one and one that cannot endure for ever, but if it is limited to the suppression of a multitude of minor improvements until it is

possible to make some really serious advance, it is quite possible that the average cost of progress will be lower. In any case, under a monopoly or otherwise, the substitution of new practice for old involves the cost of such re-adaptation of plant and skill as is practicable and the total loss of the earning capacity of all the rest.

The problem of how to pay the price of progress often arises acutely in connection with public utility undertakings. The development of motor road vehicles of various kinds has enormously affected the value of tramways and even of railways. To pretend that the motor vehicle is merely a supplement or a feeder to the older forms of transport is to shut one's eyes to facts. It undoubtedly affords, in many instances, a more rapid and convenient method of carrying passengers and goods, and to that extent is as much an example of engineering progress as tramways and railways themselves appeared in comparison with stage coaches and sedan chairs. If, under equal conditions of taxation, &c., the road and the rubber tire can ever beat the rail and the flanged wheel in all-round efficiency, as a century ago the railways beat the roads and reduced the canal systems to impotence, then the change ought to be accepted. But what would have to be accepted at the same time is the vast destruction of capital represented by the tramway and railway systems which would go out of action. The case of the tramways is the most urgent, for a tramway with its occupation gone is the most useless of nuisances, incapable of being turned to any other duty. The railways are in a different position, for their recent acquisition of road powers may enable them to take advantage of the efficiency of road transport while at the same time employing their lines more effectively by the carriage of such traffic only as can be most economically handled by rail. Every industry at one time or another finds itself threatened by some new development and the price of progress has to be paid. The bill may be presented in small instalments, enabling the industry to adapt itself to the new conditions, as when shipbuilders turned from wood to steel. Or it may be that the cost can be recouped in other directions, as when the gas companies created a demand for gas cooking and heating which more than compensated them for the invention of the electric light. In other instances it may fall overwhelmingly, as when the discovery of a synthetic product destroys an established natural industry. Technical progress of all kinds involves change, and the annihilation of previous values as a result of the change is the price that has to be paid.

The Paris Motor Show.

The tendencies observable during the past two years in favour of six and eight-cylinder engines have so far developed that the Salon de l'Automobile in Paris was essentially an exhibition of vehicles with engines of more than four cylinders. It is doubtful whether the vogue would have been so rapid in France if it were not for the example set by foreign makers, who created a need for cars of great flexibility which French manufacturers have had to supply. The conditions of driving in towns have become so arduous, and there are so many women drivers who might be deterred by the trouble of frequent gear changing, that the six-cylinder car is now regarded almost as a necessity. Moreover, the increased engine flexibility represents an advance in car design, and must therefore be looked upon as an inevitable evolution. Nevertheless, it has taken many years to introduce six and eight-cylinder engines, which, for a long time, raised problems of balance that could only be solved by experience. Not only the engines, but the complete chassis themselves have reached a stage of development that marks a great achievement in automobile engineering, and there really seems little scope for further important changes, unless they should be brought about by some invention involving new principles of mechanical propulsion. Facility for driving in cities like Paris, where the congestion at times is so great as to make traffic almost impossible, and the demand for higher speeds on the open road, have necessitated, not only increased engine flexibility, but also greater braking power and a lowering of the centre of gravity. Yet there is nothing new in the latest types of cars. All the elements constituting them have been employed and tested for many years, and the final result must be regarded as a perfect combination of the best of them.

The Paris Motor Show gave an admirable opportunity for the study of the present position. A general summary of our observation may not be without interest. We noted that while there is still some variety in the arrangement of valve gears, the aim is always to make a compact, clean, and straight engine with all gearing enclosed. As so much town driving has to be done on the third gear, this is made as silent as the direct drive, generally by meshing-in an internally toothed pinion. The plate clutch is fairly general. The engine and gear-box forming one unit are often carried on a plate fixed to the frame, thereby constituting a very rigid assemblage. Particular attention has been given to braking efficiency. Various devices are employed to multiply effort on the four-wheel brakes, the most general, so far, being a combined mechanical and compressed air control, but hydraulic methods of controlling brakes are being introduced, while vacuum brakes are fitted to the Horch cars, which are, moreover, noteworthy for several novel features. The object is to ensure a rapid, progressive, powerful, and perfectly controllable action on the brakes with a minimum of effort, and there appears to be much scope for ingenuity in this direction. The lowering of the centre of gravity has always been regarded as a desirable feature, and at times has been carried to an excess, but the danger of reducing unduly the road clearance has left makers cautious about the advisability of producing very low chassis. Nevertheless, with the high speeds now attained on the good roads to be found over most of the country, there is a decided tendency towards lower cars. The object is usually attained by carrying a dished plate on the side members and raising it along the centre to clear the propeller shaft, so that what constitutes the floor of the car is below the frame. In the same way, some overhang is given to the bodies to provide more ample seating accommodation, especially in small cars. The suspension of the chassis is a problem that has not been altogether satisfactorily solved, and the methods employed are all based upon an arrangement of springs with dampers. The fitting of wheels between the ends of two transverse springs has evidently given good results, for the system is retained on the Cottin-Desgouttes cars and a similar arrangement was seen on the German Rohr cars. This arrangement provides for ample movements, but springs cannot entirely suppress vibrations, because they act with equal force on the bound and rebound, and no better method has been found than to damp the rebound of the springs with friction or hydraulic dampers or with air dashpots, as in the case of the Harris-Laisne cars. The results obtained are good, and most of the cars are remarkably well sprung, but there is plenty of room for improvement, especially in small vehicles. Efforts to render the wheels independent of the car are carried still further in the Austrian Steyr car, in which the differential and back axle casing is hinged on a transom, so as to give it a vertical movement independent of the frame. The back part of the casing bears against a transverse spring on the chassis. After all, this only gives a relative independence, since it is impossible to avoid communicating shocks and vibrations to the car unless the springing arrangement damps on the rebound with a resistance proportionate to the load. There is still some research after automaticity, but it cannot be said that anything which will lessen the driver's power of control is desirable, and all attempts so far to introduce automatic devices have failed. Nevertheless, the Horch car has an automatic clutch on the centrifugal principle. There is evidently something attractive in the automatic clutch, but it has never been adopted except in the German car, which presumably avoids the shortcomings of the centrifugal system. Another automatic arrangement is the gearing of the back axle by means of a swashplate, which Monsieur Sansaud de Lavaud introduced a few years ago. He is still at work upon it. The resistance of the road wheels changes the angle of the swashplate and reduces the gear ratio automatically, thereby suppressing the necessity of a variable speed gear. As infinitely variable speed devices have been tried for many years past without giving practical results, it does not appear that there is much hope of any such methods replacing the improved gear-box, which, with six and eight cylinder engines, provides nowadays all the flexibility required. While cars with six and eight-cylinder engines have come into permanent vogue because they offer real advantages to users of the higher-powered cars, there is little probability of the four-cylinder engine falling out of the race for improvement. The automobile industry will depend more and more upon the very large class of users who, in France at least, have to look closely to the economy of their vehicles, and as the fuel consumption of the six-cylinder engine is at least 10 per cent. greater than that of a four-cylinder of equal power, the economy must be taken into account. It is doubtful, therefore, whether the popularity of the small four-cylinder car will be affected by the vogue of the larger number of cylinders. All the firms which have specialised in them will continue to turn out four-cylinder cars as they have been doing in the past, but Citroën is preparing for a large production of six-cylinder cars, and Renault will build both six and eight-cylinder cars, the former at the rate of 150 a day.

What will be the future of the French automobile industry? It has been so often threatened in the past, and has come so successfully out of the ordeal, that it would be unwise to indulge in any pessimism. Nevertheless, the conditions are becoming more arduous on account of the higher production cost, and, more particularly, of the taxation which imposes heavy charges, alike on the industry and on the user. Efforts are now being made to secure a reduction of the taxation upon what is the second in importance amongst the national industries. Another feature of the situation is the growing competition of foreign cars, as shown by their particularly large participation in the Paris Salon. On previous occasions, it was believed that the American exhibits were intended for the foreign trade, but there is no doubt that the imports of American cars into France are rapidly increasing. All the productions of General Motors were there. Again, the French have had to follow the lead of foreign makers, and all the foreign cars are designed upon the most approved lines, although the British, American, German, Italian, Belgian, and others are each marked with national characteristics. The Rolls-Royce, Austin, and Armstrong-Siddeley hold their own with the rest. The industry has, therefore, become highly competitive, and the French see that their chances lie more particularly in selling mass production cars at competitive prices. The Paris Show clearly revealed that there is little prospect of any further important change in motor car design. The general impression is that there can be no radical change until some means are found of employing cheaper fuels in engines weighing no more than the existing petrol engines. The Ecole Nationale Supérieure du Pétrole complains that automobile firms do not take advantage of the facilities offered by the laboratories at Strasburg to investigate the means of using heavy oils in high-speed engines. There are great mechanical difficulties in the way of doubling the compression, but the Ecole Nationale insists that it is worth while to seek a solution of a problem which aims at increasing considerably the economy of motor traction.

Obituary.

HENRY NIELD BICKERTON.

The death occurred on Sunday last, October 6th, of Mr. Henry Nield Bickerton, C.C., M.I. Mech. E., at his home, Thornycroft Hall, Siddington, near Chelford, Cheshire. Mr. Bickerton, who was seventy-three years of age, was born in Oldham, and was educated at Tettenhall College, near Wolverhampton, afterwards gaining his early engineering training in the works of his uncle, who made printing machinery. In 1880 he started an engineering business on his own account in a quite small way at Ashton-under-Lyne, and built a two-cycle gas engine, but, with characteristic foresight, he afterwards turned his attention to the four-cycle type of engine, and that was the commencement of a long and highly successful business career. In 1890 he formed the National Gas Engine Company, and great as his confidence in the internal combustion engine was at the time, he probably never anticipated the remarkable strides which that company would make in this particular branch of mechanical engineering.

Prior to the formation of the National Gas Engine Company in 1890, Mr. Bickerton had removed to another works in the same town, which had formerly been utilised by Isaac Boulton of locomotive fame, and from this small commencement the works has grown to be one of the largest of its kind in the world, standing on 30 acres of ground and finding employment for over 1000 persons. The productions of the works at Ashton-under-Lyne comprise oil and gas engines and suction plants, and the range of sizes is from 1 to 1500 horse-power, the largest size of engines being of the vertical type, some of which are now made convertible from oil to gas, or *vice versâ*. During the last year or so this company has also taken up the manufacture of crankless eng nes, which have been constructed up to 300 horse-power per unit.

In 1907 Mr. Bickerton, in association with his colleague, Mr. Charles Day, acquired the rights of Mirrlees, Watson an l Co. in the Diesel engine, and

founded the company of Mirrlees, Bickerton and Day, Ltd. A large area of land was bought at Hazel Grove, adjoining the L.M. and S. Railway main London–Manchester line, and on it the present works were erected. The engines built on the Diesel principle range from 25 to 1000 brake horse-power, operating on the four-stroke cycle, and from 40 to 2000 brake horse-power operating on the two-stroke cycle. Recently this firm and Mirrlees, Watson and Co., Glasgow, joined forces, and the two companies are now managed by the same board of directors.

Mr. Bickerton was a man of sound judgment in commercial affairs, and possessed in a remarkable degree the determination to succeed, which is a characteristic feature of Lancashire men. Like many very busy men, he found time to take part in the public affairs of the town which he had done so much to make famous in the engineering world. For more than twenty years he was a member of the local Town Council and was elected Alderman in 1922. If his health had not broken down, he would probably have succeeded to the mayoralty. He was a Justice of the Peace for Lancashire, and member of the County Council.

It was in 1912 that Mr. Bickerton purchased his beautiful Cheshire home and the Thornycroft estate of 700 acres. The house is an historic mansion which dates back as far as the thirteenth century, and its owner was always most generous in throwing open the hall and grounds for the benefit of any charitable object. Many members of the Institution of Mechanical Engineers and their ladies spent a very enjoyable afternoon at Thornycroft Hall during the visit of the Institution to Manchester last summer. Mr. Bickerton himself, however, was too unwell to be present in person.

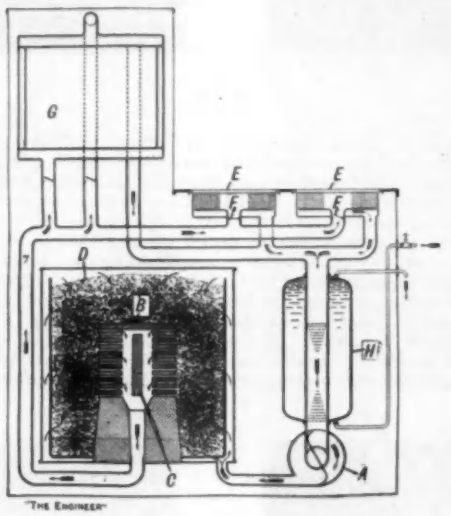
The Electric Cooking Load.

The electrification of Switzerland has now reached a stage at which the electricity supply undertakings must look mainly to the consumption of energy for cooking for any further considerable increase of revenue. The installation of ordinary electric cooking stoves is, however, sometimes impossible, or at any rate undesirable, from the point of view of the power stations. As the result of numerous investigations it has been found that the daily electric cooking consumption in a household amounts to 1 kWh per head, and as the average Swiss family consists of four persons the average cooking load per household is 4 kWh. It may happen, however, that if all the cooking points are in operation at the same time the demand on the system may reach 5·8 kW. As is well known, the ratio of energy consumption to maximum demand has a marked influence on the selling price of electricity. In the case mentioned, provision has to be made for the supply of 4 kWh during a short period daily to apparatus which, if used continuously, would give rise to a demand of 140 kWh. The conditions are somewhat better when current is supplied to a group of houses, as all the cookers are not likely to be in use at the same time, or, at any rate, they are not likely to be working at their full capacity at the same time. Up to a point the more stoves that are connected to a system the better do the conditions become, but the peak load cannot fall below a certain value, for the habits and customs of people do not differ widely.

Investigations in Switzerland show that on about 100 standard cookers connected with an oven and three hot plates the average cooking current peak per household is about 1 kW, and that this peak cannot be reduced by the additional connections in the same area of supply. If a power station and distribution network were constructed solely for a cooking load the conditions would be very unsatisfactory, for the cost of the installation and the quantity of energy that would be sold would be in a very unfavourable ratio. In practice other things produce peaks, such, for instance, as lighting installations. The lighting peaks do not, however, coincide with the largest cooking current peak which occurs at mid-day; in the evening the cooking load peak is less.

In Switzerland it is estimated that 100,000 households cook wholly or partly by electricity, but the conclusion that some Swiss engineers have reached is that, in order to electrify the kitchen satisfactorily on a large scale, the short-period energy consumption of the electric cooking stove with its high loading of short duration must be converted into a demand uniformly distributed over the twenty-four hours and without a peak. The idea of constantly drawing a relatively small amount of electrical energy from the mains and storing it in the form of heat and utilising the heat during the cooking period is not new, but up to the present the scheme does not appear to have made very much headway.

The Seehaus storage range, however, works on a new principle and is expected to overcome the difficulties with which the electricity supply undertakings have hitherto been faced. Its maximum energy consumption ranges from about 450 to 600 watts and it may, if necessary, be connected to a lighting circuit. The operation of the stove is dependent on air circulation produced by a small fan, shown at A in the accompanying illustration. The heat reservoir consists of a cast iron core B in which the electric heating element C is inserted and a quantity of sand D, which surrounds the casing and which is held together by a perforated cover, the whole being surrounded by an air-tight sheet iron casing. E are hot plates with regulating valves F. G is the oven and H the water heater. The heat stored in the cast iron element and by the sand is taken up by air which penetrates into the sand on all sides and which passes towards the central casing and then flows, as indicated by the arrows, to the various cooking points. The heat generated by the heating element and subsequently imparted to the sand is thus supplied to the various parts of the cooker, the temperature being highest in the sand near the centre casting and lowest at the outside close to the cover. The air arrives at the core in a preheated condition, and with the arrangements described the heat losses in the storage system are said to be small. The principle of the apparatus is described as follows:—If a wall at the temperature of the surrounding air be electrically heated on one side—say, the inside—then a certain time will elapse before the temperature begins to rise appreciably on the other side of the wall. If the heating process be continued, a definite and invariable temperature will be established on both sides of the wall. All the heat applied to the inner surface of the wall flows continuously through the wall and out through the other wall surface. If the outflowing heat be regarded as loss in this so-called "stationary" condition the efficiency is nil. Conversely, at the commencement of heating the efficiency is 100 per cent., as no heat flows out, this being the result of the storage capacity of the wall without which the stationary condition would set in immediately. The heat conductivity of the sand plays an important part in the process, because the difference of temperature on the inside and outside, the heat capacity of the wall, and hence the time element is dependent upon it. If the heated wall be artificially cooled from the outer surface by driving through air from the outside, practically no



HEAT STORAGE COOKING STOVE

heat will flow outwards, for it is carried inwards by the air. Even after the interruption of the air current, some time will elapse before a sensible temperature again appears on the outer wall surface, for, at first, all the heat flowing to it from the hot side of the wall is taken up by the artificially cooled external wall parts. Thus during and after cooling there is almost a stationary condition on the inside of the wall, whilst on the outer surface of the wall we have the initial condition of heating up at the same time. Obviously there is a tendency to compensate the distorted and unnatural temperature distribution, and the wall must be dimensioned so that the losses remain within fixed limits. In a stove constructed on this principle it is possible to store heat without insulation and to dissipate it when required. The storage capacity of the system is very appreciably increased by the sand. The efficiency of the stove is, of course, greatest when the returning cooling air is coolest, and in its construction this fact has been taken into consideration. As shown in the illustration, the hot air first serves those points that require high temperatures, such as the oven and cooking plates, and afterwards a plate for the continuance of cooking, which is not shown in the illustration. It then serves the hot water tank, in which the counterflow principle is also adopted. The cold water enters below the heater and leaves above, whilst the hot air enters above and leaves below.

As the heating medium is air there is no difficulty in supplying heat to the various cooking points. The heat transmission is not affected by direct contact between utensils and the storage unit, as in the case of another storage stove that has been developed in Switzerland. Air, however, is a bad conductor of heat; moreover, in a stove of this type it is not possible to work with such high temperatures as those that prevail in coal and gas stoves. If the hot air from the heat reservoir merely played on the outside of the utensils or below a cooking plate on which the utensil stood then, owing to the relatively low temperature of the air, the heating effect would be quite inadequate. It is claimed, however, that, with the form of construction adopted, adequate temperatures and volumes of heat are imparted to the cooking plates and that the supply of heat can easily be regulated. On the underside of the cooking plates there is a large number of metallic segments, which are exposed to the hot air current, the superficial area of the segments being many times greater than that of the plates. The construction is such that the whole of the air current is compelled to pass through these heating surfaces. The regulating valves or dampers allow the outputs at the various cooking points to be adjusted as desired, and it is claimed that the regulating properties of the stove are superior to those of a gas cooker, especially as regards low settings. The motor which drives the fan has a short-circuited rotor which runs in ball bearings and needs no attention.

An experimental cooker of this type has been tested by the Materials Testing Laboratory of the Swiss Electro-Technical Union to the instructions of the Swiss Association of Electricity Works, and the results are said to have proved highly satisfactory. With a 400-watt loading for twenty hours the stove only consumed 16 per cent. more energy than a directly heated cooking stove designed for the same cooking and water heating duty. Another stove constructed on the same principle was exhibited at the "Saffa" at Berne and created much interest among electrical men. Stoves of this type are shortly to be placed at the disposal of the Swiss electricity works for trial, and we await the results with interest. The inventor of the stove is Mr. P. Seehaus of Mitlödi, Canton Glarus, Switzerland.

SIXTY YEARS AGO.

A list of "British Engineers and others in Paraguay," published in our issue of October 8th, 1869, requires some explanation before its significance can be understood. When it is understood, it will be found to be an echo of as bloodthirsty a war as South America has ever experienced, a war in which British engineers and others of their countrymen played not unimportant parts on both sides. Francisco Lopez, on his father's death in 1862, succeeded to the presidency of Paraguay. The elder Lopez had been a firm but patriotic despot, and under his rule the country had rapidly advanced in prosperity. His son, denied the educational advantages which Carlos Lopez had enjoyed, had for long cherished ambitious designs of conquest against the neighbouring republics. Soon after coming to power he enlarged the army and purchased quantities of military stores in Europe. In 1864 he began by seizing a Brazilian steamer at Asuncion, and by invading and sacking the Brazilian province of Matto Grosso. Next he declared war on Argentina. Seizing two Argentine warships in the Bay of Corrientes, he announced the annexation of the provinces of Corrientes and Entre Rios to Paraguay. By May of 1865 his state was at war with Brazil, Argentina and Uruguay. For five years the war was fought with great stubbornness. Fortune at first hesitated to descend on either side, but latterly Lopez began to experience a steadily increasing tide of disasters. In 1868 he was being hard pressed. He conceived the belief that his own adherents were conspiring against his life. Acting swiftly, he seized and executed several hundred of the chief Paraguayan citizens, together with more than two hundred foreigners. At last, with but a handful of troops, he was driven north, and on April 1st, 1870, he was killed by Brazilian soldiers while endeavouring to escape by swimming a river. The list which we published contained the names of a number of men, mostly engineers, women and children, who had reached the Brazilian lines after living in captivity under Lopez's rule at Caacupé. Her Majesty's ship "Cracker" had played a part in their rescue. What, we may ask, were these British engineers engaged upon in Paraguay? Reading between the lines, we can see that many of them had been in Lopez's employ or had been captured when in the employ of his enemies and forced to work for him. For example, Mr. George Miles was second engineer of the Argentine war steamer "25 de Mayo" when Lopez seized her at Corrientes. The chief engineer, Mr. Hugh Bain, died, but Mr. Miles was employed by Lopez to cast 12-pounder guns from church bells and Brazilian shot. These guns were rifled by Captain Thompson, an Englishman voluntarily in Lopez's employment. Mr. Miles was among the refugees, but Captain Thompson, Dr. Skinner, Mr. Nesbitt, chief of the arsenal, Mr. Hunter and Mr. Taylor chose to accompany Lopez in his flight. What their fate was we do not know. Nor do we know what eventually befel Madame Lynch, Lopez's kind-hearted Irish mistress, or Mr. Washbourne, who for five months protected some of the refugees in his house behind the American flag. The few personal details which survive in our pages stir the imagination, but as records of facts they are tantalisingly unsatisfying and incomplete.

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Problems in Electrical Engineering: With Answers. Edited by S. Parker Smith, D.Sc., M.I.E.E. London: Constable and Co., Ltd., 10-12, Orange-street, W.C. 2. Price 6s. net.

Select Methods of Metallurgical Analysis. By W. A. Naish, Ph.D., A.R.S.M., &c., and J. E. Clennell, B.Sc., &c. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 30s. net.

Gauges and Fine Measurements. Two Volumes. By F. H. Rolt, M.B.E., B.Sc., &c. Edited by Sir R. T. Glazebrook, K.C.B., F.R.S. London: Macmillan and Co., Ltd., St. Martin's-street, W.C. Price 42s. net.

The Slacks Valley Power Station of the Oldham Corporation.

The history of the Oldham Corporation electricity supply resembles very closely that of many other municipalities. In 1892 the Corporation received the Local Government Board sanction to borrow a sum of £27,000 for the erection of a generating station and to lay the necessary mains. Early in 1894 Rhodes Bank station was opened, the plant consisting of two Lancashire boilers, two 36-kW and two 60-kW engines and dynamos. This plant was soon increased by the addition of two 120-kW engines and dynamos, the capacity of the station being 432 kW. In 1896 the system of distribution was changed from a two-wire to a three-wire supply, the pressure to the consumers being either 210 or 105 volts. Further extensions were made in 1897, 1898, and 1900, which brought the station capacity up to 1332 kW. The demand continued to increase until, in 1902, further prospective consumers had to be refused. Subsequently the existing station at Greenhill had to be built, and the Corporation has carried on with that station until the present time. In 1922 the plant in that station amounted to 21,200 kW and in 1925 to 32,000 kW. When the maximum demand reached 23,000 kW the Electricity Committee again had to reconsider its position, and it was decided that further extensions of the Greenhill station were not possible. It was determined that the best site for a new station was at Slacks Valley, Chadderton, and sanction of the Electricity Commissioners to build it was granted in 1925. In the meantime the Urban District Councils of Crompton, Chadderton, Royton, and Lees applied for Electricity Orders, which were obtained and transferred to the Oldham Corporation, thereby extending considerably the Corporation's area of supply. Excavations were commenced on the Slacks Valley site in November, 1925.

The Slacks Valley station is built on land adjoining the main line of the L.M.S. Railway from Manchester to Yorkshire on the west and the Rochdale Canal on the east. The area of the site is about 34 acres and the entrance to the works is on the new Manchester-Chadderton arterial road. The present generating capacity of the station is 37,500 kW, but it is capable of being extended ultimately to 160,000 kW of plant.

The ground on which the station is built offered somewhat difficult problems of construction, for the top surface was a layer of peat with plastic clay and sand below, which necessitated the use of a large number of concrete piles for both the main building and the water cooling towers. The site, however, presented compensating advantages in that it will be possible to transport coal from the Lancashire coalfields by way of the Rochdale Canal, whilst two short siding connections to the L.M.S. Railway on the west side put the works in direct communication with any railway in the country, ample siding accommodation being provided for both full and empty wagons. Coal can therefore be delivered by rail or canal, the wagons being hauled and marshalled by means of a fireless locomotive and two electric capstans over three tracks of rails, one of which passes over two railway-type weighing machines and the coal receiving hopper. The coal, unloaded by means of two electrically-driven ram tippers placed between the rails, is discharged into the receiving hopper, whence it is carried by means of an automatic filler into an endless chain gravity bucket conveyor, capable of dealing with 80 tons of coal per hour, to the main storage bunkers in the boiler-house, which have a total capacity of 900 tons

Layout of the Site.

The station as at present constructed consists of a turbine house, 143ft. 6in. long and 70ft. wide, with a height of 47ft. 6in. to the crane rails and 60ft. to the eaves of the roof. Adjacent to and parallel with the turbine-house is a switch house, which is divided into three floors, the condenser pumps being in the basement, the switch room on the second floor, and the control room on the third floor. The administrative offices are at the permanent end of the switch house.

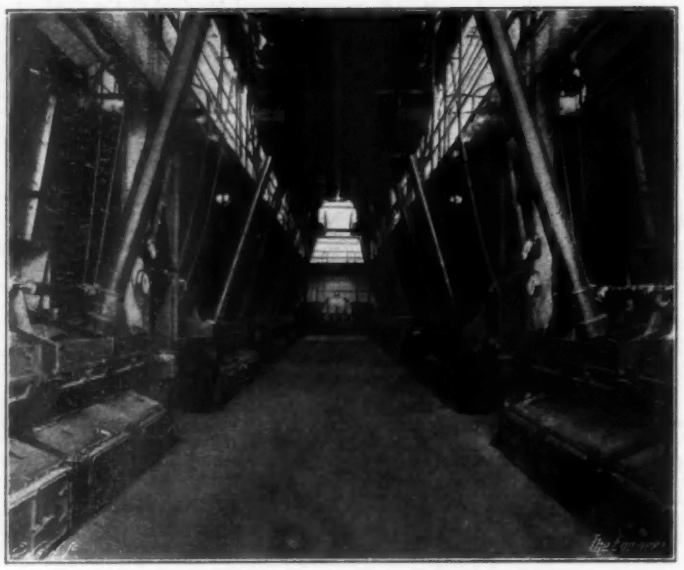
The boiler-house, which is at right angles to the turbine-house, is 140ft. long by 120ft. wide, with a total height of 53ft. to the eaves. The boiler feed pump house is situated between the boiler-house and the turbine-house, and is parallel with the latter.

The buildings are of steel framework with brick filling, the exteriors of the walls being faced with Accrington brick and Yorkshire stone, while above the turbine-house floor level the inside walls are finished with glazed blue and white tiles, which give a very bright and pleasing effect. Every effort has been made to provide first-class daytime lighting, and this is a particularly noticeable feature of the boiler-house.

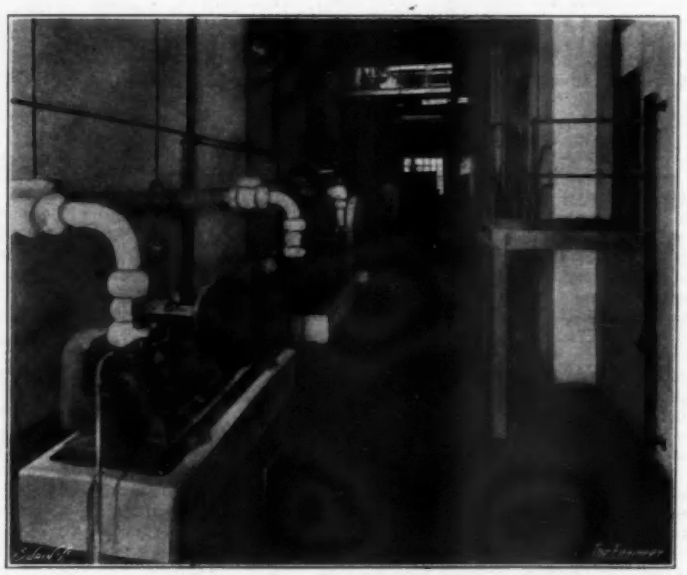
The basement of the boiler-house is arranged at ground level. A horseshoe track enables the ashes to be directly removed from the hoppers beneath the boilers by motor or railway wagons and to be tipped on the site. The contour of the ground lends itself to this method of disposal for a considerable period of time. A special feature of the plant is an ash conveyor having a capacity of 5 tons of fine slack per hour, which is used for the recovery of riddlings and fine coal.

Coal Wagon Tippers

Overhead Coal Bunkers



Interior of Boiler-House



Pump-House

Steam-raising Plant.

The steam-raising plant consists of eight cross-tube marine type water-tube boilers, by Babcock and Wilcox, each capable of evaporating 50,000 lb. of water per hour under normal working conditions. The plant is constructed to operate at a working pressure of 295 lb. per square inch, whilst the superheaters are capable of imparting a final temperature to the steam of 700 deg. Fah. Each boiler is set singly and is entirely self-contained and enclosed in

steel casing, each unit being equipped with a vertical cast iron steel-cased economiser, having an effective heating surface of 4500 square feet, an induced draught fan, by Davidson, driven by a Lancashire Dynamo Company's electric motor, and a steel chimney 7ft. in diameter, 80ft. in height.

To obtain as much natural light as possible, and for easy access, the Green's economisers have been placed immediately behind the boilers, while the fans and motors have been arranged immediately underneath the economisers at the firing floor level. The furnaces are fitted with mechanical chain-grate stokers, each boiler having two grates with a total grate area of 324 square feet per furnace.

The stokers are arranged to operate under simple induced draught conditions, but arrangements have been made so that the necessary closing-in plates can be readily added to the plant at a later date should it be considered desirable to introduce forced draught plant for operating the stokers under balanced draught conditions.

The arrangements for ascertaining the efficiency with which the station is operating are very complete. They include a tank at the north end of the pump house which can be isolated at any time, so that any turbine can be put on load and test conditions. Discharge from this tank can be passed to a tank erected on a weighbridge on the pump house floor, where the whole of the condensate can be weighed from any one turbine. This tank, after its contents has been weighed, discharges into a further tank which is placed on the condenser floor in the turbine house, and the weighed water is pumped from this tank back to the common feed system.

The boiler feed pumps are placed in the pump house, which lies, as mentioned previously, between the boiler-house and the turbine-house. Six pumps are provided, four—by Mather and Platt—being electrically driven and two—by Weirs—being steam driven. Together these pumps have a capacity of 95,000 gallons per hour. Four large condensate, surge and make-up water tanks are erected in the upper portion of the pump-house, so that water flows by gravity to the feed pumps. A Permutit water softening plant for boiler make-up is also provided.

The condensing water passes through three duplex water cooling towers having a total capacity of 1,800,000 gallons per hour. In addition, sufficient condensing water for one 12,500-kW set can be obtained from the canal on the east side of the station. It is intended to obtain the make up water for the cooling tower evaporation from filtered sewage effluent from the Corporation's sewage works on the other side of the canal.

Switching Equipment.

The switch and control rooms on the east side of the turbine-house are arranged so that the operator in the control room has a complete view of the turbine-house, which obviates the necessity of installing signalling apparatus. The switch room is equipped with Ferguson-Pailin extra high-pressure metal-clad switchgear, remote controlled, and fully interlocked so that it can be handled with perfect safety.

Turbo-alternator Sets.

The turbine-house at present contains three 12,500-kW turbo alternator sets, and there is space for future extensions to the station, which will finally have a capacity of about 160,000 kW. The generating sets, with their condensing plants and auxiliaries, were manufactured and supplied by Metropolitan-Vickers Electrical Company, Ltd., of Trafford Park, Manchester. Each set is capable of supplying a normal output of 12,500 kW at 6600 volts at 3000 r.p.m., with an overload capacity of 25 per cent. for two hours. The turbines are designed for an initial stop valve pressure of 250 lb. per square inch gauge, with a total temperature of 650 deg. Fah. and a vacuum at the turbine exhaust flange of 28·2in. of mercury at normal load. They are of the two-cylinder or tandem type with cast steel high-pressure cylinders having relatively small mean diameters with low steam velocities and low mechanical stresses. The corresponding low-pressure cylinders are made of cast iron and incorporate a number of Rateau impulse stages with Baumann multi exhaust.

Steam for the turbines is controlled by means of a throttle valve arranged for automatic closing in an emergency, and also a single throttle valve under the control of the governor. For overload conditions additional steam is automatically by-passed to the fourth stage of the turbines. Four comparatively small diameter pipes provide a flexible connection from the steam chest to the turbine cylinder. The turbines are arranged for two-stage feed heating, the first stage heater being integral with the turbine, whilst the second stage is in the form of a separate heater, the final feed water temperature being 178 deg. Fah.

The glands adopted for both ends of the high-pressure cylinder and also the high-pressure end of the low-pressure cylinder are of the latest form of labyrinth glands developed by the Metropolitan-Vickers Company. They provide a number of points at which throttling of the steam takes place, while both ends of the low-pressure cylinder are provided with paddle-wheel type water-sealed glands. A Michell thrust bearing is arranged on each cylinder spindle. A Wellman-Bibby coupling joins the two turbine shafts, whilst the coupling to the alternator is of the corrugated semi-flexible type. Pipes with corrugations on each side of the machines give flexible connections between the two cylinders.

The governor is of the same pattern as those fitted to the self-contained turbo-generators manufactured by the Metropolitan-Vickers Company which were described in the issue of The Engineer for October 5th, 1928. This type of governor has, we understand, achieved considerable success and was specially developed for high-speed rotors having a comparatively light weight and small diameter. Owing to the reduced inertia in this form of high-speed rotor, speed regulating gear of extreme sensitivity is very necessary. The oiling system of each turbine is complete with pump, tank, coolers, and Vickers separator and arrangements are made so that the separator can be put into service whilst the turbine is on load and also in order that the oil can be drained from any turbine oil tank to the central storage tank.

Alternators.

Each alternator is capable of a normal full-load output of 12,500 kW at 0·8 power factor, and runs at 3000 r.p.m. Three-phase, 50-period current is generated at 6600 volts between phases, and the alternators are each capable of this output continuously without the temperature rise exceeding 40 deg. Cent. The machines are of the usual two-pole rotating field type. The concentric form of winding is adopted for the stator, and the makers' method of transposition is used for the conductor straps in order to reduce eddy current losses. The stator laminations are of the highest-class silicon alloy steel, having specially low watt loss characteristics.

The rotor of each machine is a solid forging and the windings are insulated with mica and asbestos only. The diameter of the rotor is 33·9in. The normal full-load current at 12,500 kW is 1368 ampères, whilst the field current at that load is 162 ampères at 183 volts. The exciter for each machine is direct coupled to its alternator, and is of the overhung type with a single-face radial form of commutator. Control of the alternator is by a rheostat in the field of each exciter.

An automatic pillar-mounted type field switch arranged adjacent to the exciter operates in conjunction with the system of "self-balancing" protective gear which takes care of unbalanced short circuits and "earths" on the alternator itself. In this system the main cables, both entering and leaving each phase of the alternator, are passed in opposite directions through one of three "ring" type transformers, which are arranged in the alternator housing. For further protection of the cables from the sets to the bus-bars copper sheaths are provided on the main cables, these sheaths being insulated at the bus-bar end and earthed at the generator end, after passing through the protective transformers. Thus any fault on the cable system will result in an unbalanced condition, and the secondaries of the protective transformers will therefore operate the tripping relays, &c. This protective scheme is arranged for a minimum fault trip of 35 ampères. The star point of any of the generators may be earthed through a resistance which is designed for a limiting current of 1000 ampères.

The alternators are furnished with the Metropolitan-Vickers system of closed circuit ventilation, which is combined with an external fan and emergency damper equipment. The total air in circulation is 50,000 cubic feet per minute, of which 25,000 cubic feet is delivered by this separately-driven external fan. The arrangement of the damper gear permits operation of the alternator ventilating system both with or without the external fan, as required. Thus, at reduced loads it is possible to place the fan out of commission, thereby effecting a corresponding saving in power. The coolers of each alternator are arranged in two units, each being of the finned-tube type and arranged so that they may be withdrawn from their normal position in the foundations for inspection and repair. Each fan is driven by a 90 horse-power squirrel-cage motor running at 960 r.p.m., supplied from the 400 volts low-tension system. The Harris-Anderson patented anti-corrosion system referred to later, which is installed for protecting the condenser tubes and oil coolers against electrolytic action, is also connected up to the air coolers of the alternators for the same purpose. These coolers are supplied with water from the condenser circulating water system.

Control Room

Switch House

Condensing Plants.

Each equipment comprises a central-flow surface condenser, together with the necessary extraction pump, rotary air pump, stand-by steam-operated air ejectors, and circulating water pump. The condenser has a cooling surface of 16,600 square feet and has a cast iron shell. The tubes are made from 18 S.W.G. thick material and have an external diameter of $\frac{7}{8}$in. The extraction pump discharges the condensate through the ejector heater, integral heater, gland steam heater, and external heater, direct to the suction of the boiler feed pump. An elevated surge tank, combined with a Lea recorder tank, is provided at the suction to the boiler feed pumps. The Lea recorder can be brought into operation whenever desired by by-pass valves. Each extraction pump is driven by a 44 B.H.P. squirrel-cage motor, operating on the 400-volt low-tension system and controlled by a star delta starter. The air pump is of the Le Blanc type and is driven by a 52 B.H.P. squirrel-cage motor at 1440 r.p.m. The air ejector is of the two-sta e type, with surface interstage, and after coolers. Each condenser is provided with a steam-operated air exhauster

to facilitate obtaining a good vacuum quickly when starting up.

Each circulating water pump is capable of delivering 15,690 gallons of water per minute and is driven by a 395 B.H.P. motor running at 585 r.p.m. The pumps were supplied by Mather and Platt and are driven by Metropolitan-Vickers slip-ring motors, provided with oil-immersed starters. Cross connections are provided on the discharge and suction sides of the three pumps, and also before the inlets to the three cooling towers, which are each of 600,000 gallons per hour capacity, and which were supplied by the Premier Cooler and Engineering Company.

The condensers, together with the air coolers and also the oil coolers, are protected against electrolytic action by means of a special electrically-augmented patented anti-corrision system supplied by Messrs. Harris Anderson. The motor generator sets which supply current for all this equipment in the stations are each of 18 H.P., and together with the necessary control switchgear were supplied by Metropolitan-Vickers Electrical Company, Ltd.

The auxiliary motor protective equipment for the control apparatus of the various condenser motors, and also the alternator fans, are arranged with three overload coils and a single no-volt tripping coil.

Switching Equipment.

The main 6600-volt switchboard is of the duplicate bus-bar electrically-operated draw-out metal-clad type and controls three 12,500-kW turbo-generators and six group feeders. Each machine circuit is provided with two triple-pole oil circuit breakers, each having a rupturing capacity of 1,500,000 kVA so that these circuits can be connected to either bus-bar as desired.

For the six feeders three double-circuit units are provided. Four of the circuits feed two five-unit remote electrically-operated subsidiary feeder switchboards, comprising type H.V.D. metal-clad switch units, whilst the remaining two feed a three-panel electrically-operated duplicate bus-bar stationary cubicle type switchboard for controlling the high-tension side of the 1000-kVA, 6600/440-volt station transformers. The circuit breakers on this switchboard have a rupturing capacity of 250,000 kVA.

The group feeder circuit breakers connected to the front bus-bars feed direct on to the front bus-bars of the subsidiary switchgear and similarly the rear breakers feed direct on to the rear bus-bars of each subsidiary board. One of the feeders on each of the subsidiary switchboards serves as an interconnector with the original Green Hill power station. The three station transformers feed the 440-volt power-house switchboard, which is of the single-bus direct manually operated stationary cubicle type sectionalised by means of 2000 ampère bus-bar section switches. The star points of the alternators are connected to a three-panel electrically-operated cubicle type selector switchboard, the bus-bar of which is connected by means of cable to a grid type earthing resistance, arranged to pass 1000 ampères for thirty seconds. The main earthing system comprises a plurality of cast iron earth plates interconnected by means of copper strap, links being provided to facilitate testing.

The machines are fitted with the self-balanced type of protective gear which is interlocked with the field suppression pillars so that the latter equipment operates when the breaker opens under internal fault conditions only. Standby definite time limit overload protection is also provided. The group feeder circuits have triple-pole over-current protection, the relays being arranged with those on the subsidiary feeders, so that on the occurrence of a fault beyond the breaking capacity of the sub-feeder switches the current would be dealt with by the main group feeder breakers. The group transformer feeders are similarly protected. The feeders on the subsidiary switchboards are protected by means of inverse time limit over-current characteristics and also instantaneous acting leakage relays. The low-tension transformer circuits are fitted with triple-pole over-current trip coils with time limit fuses and the radial feeders have double-pole over-current and leakage protection.

The control and relay equipment for the main switchgear is mounted on separate desk type control panels, which, along with the synchronising pedestals, are arranged in a room above the main switch room and overlooking the turbine-house. The control panels for the subsidiary switchgear are of the flat-back type with rear access doors, the whole being surmounted by an automatic indicator board carrying a single-line diagram of the main electrical connections of the station. Mounted separately in the same room is a combined control board for the E.H.T. works power switchboard and for the control battery switchgear. The Tudor battery, which is in an annexe to the control room, comprises 126 cells having a capacity of 800 ampère-hours at the ten-hour rate. This battery, besides being available for energising the closing and tripping circuits of the whole of the switching equipment, is of sufficient capacity to satisfy the emergency lighting requirements.

The whole of the circuits have a full complement of instruments, including metering on the generator circuits, whilst a complete synchronising scheme is embodied. This scheme prevents an operator from switching the incoming supply on to the bus-bars before the synchronising operation has been performed, and also prevents closing on to one set of bus-bars when synchronising against a circuit connected to the other set of bus-bars. Synchronising facilities are provided on the generators, the group feeders and also the interconnectors on the subsidiary switchgear, so that, according to the conditions, the operator can synchronise on the interconnector switch or on the group feeder switch. A bell alarm system is also embodied. It operates when fault current is flowing through the earth limiting resistance or whenever a breaker on the switchgear or subsidiary switchgear trips under fault conditions.

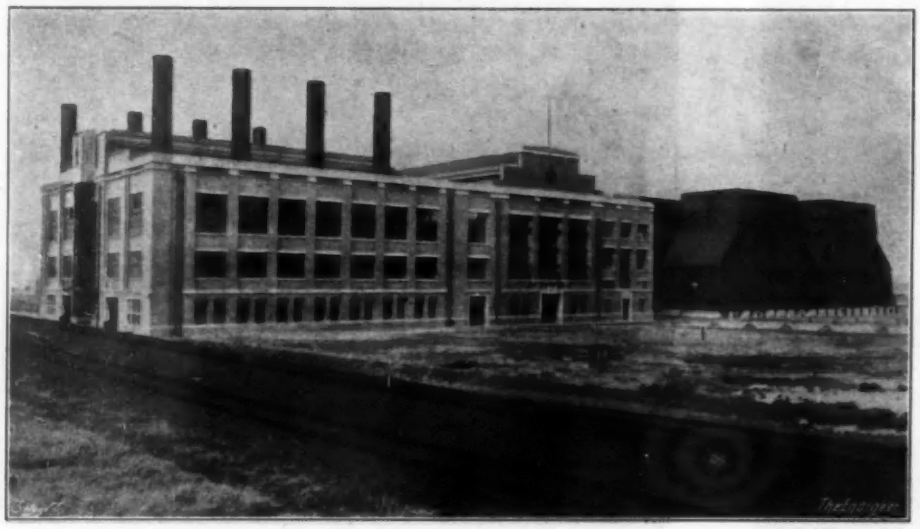
The metal-clad switchgear employs vertical isolation of the oil circuit breaker, which, in both instances, is carried out by motor-operated gearing controlled by means of raising and lowering screws, which form an integral part of the structure of the unit.

An interesting feature of the main type J.V.D. switchgear is that each phase has a complete non-magnetic earthed metal enclosure throughout, so that should any faults develop they will be earth faults only, the fault current being limited by the neutral earthing resistance.

The metal-clad voltage transformers have their own isolating features, so that work can be carried out on them without disturbing the main circuit. On account of the compactness of both types of metal-clad switchgear and the small area of floor space required with vertical isolation, both the main and subsidiary switchboards have been accommodated in a single room immediately below the control room.

The work of draining and levelling the site previous to building was carried out by the Corporation by direct labour and the structure was erected by contract. The total cost per kilowatt installed works out at £15. Mr. Robert Blackmore, A.M.I.E.E., acted as consulting engineer for the station, and Mr. F. L. Ogden, electrical engineer to the Corporation, supervised the engineering work.

A series of photographs of different parts of the station is reproduced herewith and on page 386.



General View of Slacks Valley Power Station

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

TECHNICAL EDUCATION FROM A STUDENT'S POINT OF VIEW.

Sir,—As an old-time student of a Scottish University, gratitude and respect for my *Alma Mater* compel me to caution your readers that the picture drawn by the writer of your recent series of articles should not be taken as a true representation of the conditions prevailing in *all* colleges and institutions which aim at educating engineers.

I have studied the curriculum of the mechanical engineering course given by your author in his second article, and have compared it with that which I followed. The contrast is as sharp as it well could be, and is not at all, I think, to the advantage of the syllabus which your writer gives. It is not so much in the details as in the general idea lying behind the scheme of studies that my interest lies. The syllabus given by your writer may or may not assist men to become mechanical engineers. Of this I am certain; it will not help them to become anything else but mechanical engineers. It will neither cultivate in them nor encourage them to cultivate for themselves that wide love for all knowledge which is the true aim of education and which is as essential to the engineer as to every other professional man.

Let me recall my own University training, not in any spirit of boastful superiority, but in order to show the working out of an opposite principle of education. We were required in the first place—those of us at least who had not obtained the School-leaving Certificate—to pass a preliminary examination. Proficiency in at least one foreign language was included in that examination, and it is perhaps worthy of note that Greek or Latin might be offered, and indeed the offering of one or the other was expressly encouraged. Engineering candidates for admission were accorded a special privilege. They were permitted to attend the University classes before they passed the preliminary examination, and to count such attendance towards their degree course. This privilege was of immense value in many ways, which I need not stop to recount, to those students who followed the system strongly recommended by the University authorities of studying during the winter months and of working their apprenticeship during the summer. This, the "sandwich," system, was adopted by practically every engineering student, so much so that during the summer—from April to September—the engineering department of the University was closed down.

Our first year after—or before—passing the preliminary examination was given up to the study of three subjects, natural philosophy, mathematics, and chemistry. The chemistry class was a large one, for it included budding chemists, engineers, and doctors. No attempt was made at this stage to distinguish the professions. So, too, in the natural philosophy and mathematics classes. We worked alongside the medical and arts students without distinction. Our classes began at 9 a.m. and finished before 1 o'clock. The rest of the day was free for private reading and study. We were, however, strongly encouraged to attend classes outside those required for our degree course, and not a few entered themselves for geology, French, German, &c., the classes in which were arranged on certain afternoons.

In our second year we continued our natural philosophy and mathematics classes, physical laboratory work being included in the first named. The medical students had now left us, but the arts students and those who intended to specialise as physicists were still with us. We had our afternoons free as in the first year, except for such extra classes as we chose to attend. In addition to natural philosophy and mathematics, we made in this year our first acquaintance with the engineering department and its professor. From 9 a.m. to 10 a.m., and on certain days during the succeeding hour, we attended lectures on the materials of engineering, their production and strength. It was possible, too, for the mechanical engineer during this year to study electrical engineering, the lower division class in which began at 8 a.m. On two or three days in the week we attended in the afternoon in the engineering laboratory. We were left entirely to ourselves to carry out the tests, even to the extent of effecting repairs or making any new experimental apparatus that might be required. Most of us, you will understand, were by this time fairly skilled with our hands. Our skill had been acquired as apprentices during the summer months or previously to our entering the University. Workshop skill was not taught in the engineering department. It was not considered the function of a University to train men as mechanics.

At the end of our second year we would essay our intermediate degree examination. If we failed to satisfy the examiners in March we could sit again in September after a summer of private study.

During our third year we were recognised wholly as engineering students and spent all our time in the engineering department. It was still possible, however, to attend extra classes outside the degree course. Our afternoons were occupied by work in the laboratory or the drawing-office—never by lectures—but the curriculum was so drawn as to allow us several free afternoons for private study. At the end of our third year we sat for the final examination, and, if successful, were duly "capped." If we failed we could return to the shops—or drawing-office—for the summer and sit again in September.

The University regulations required us to spend a

minimum of three years—that is, three winter sessions of about six months each—at the University before we could obtain a degree. We were, however, urged by the authorities to spread the course over four years, and most of us did, in fact, do so.

I am aware that the engineer's curriculum at my old University has been changed since my day, but it is still, I believe, distinguished by the broad liberality of that which I followed, a liberality founded on the belief that an engineer to be a successful engineer must be something more than an engineer.

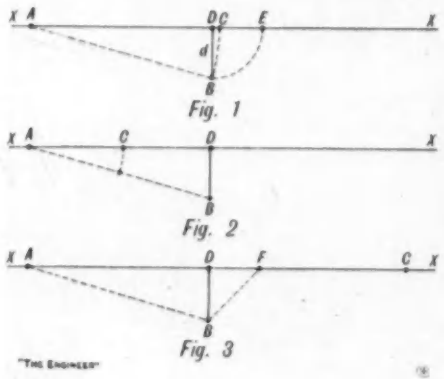
B.Sc. (GLASGOW).

October 8th.

SCHNEIDER CUP SPEEDS.

SIR,—The question propounded by "Summit" in your current issue can be easily answered. The answer, nevertheless, may prove startling. An aeroplane approaching an observer in a straight line, with a speed equal to the velocity of sound, would be noiseless until it was directly overhead.

In Fig. 1, let X X be the path of the aeroplane and B the position of the observer. Let the aeroplane start at A. Join A B and lay off A C along X X equal to A B. Then, since the machine is flying at the speed of sound, the noise



which it emitted at A will be received at B when the machine is at C. The point C, no matter where the starting point A may be, and no matter at what height, *d*, the machine passes over the observer, must be situated to the right of the overhead point D. If the machine starts at some distance A D, which is great relatively to the height *d*, the point C will be substantially coincident with the overhead point D.

Along X X lay off D E equal to D B. Then the noise emitted by the machine when it is at D will be received at B when the machine is at E.

It follows, therefore, that while the machine is flying from A to D the observer will hear nothing, and that all the noise emitted between A and D will be received at B during the interval occupied by the machine in flying from D to E; that is, a distance equal to the height *d*. This interval, if *d* is 1100ft., will be 1 second, since the speed of sound is approximately 1100ft. per second.

After the machine becomes audible at D it will remain audible more or less as at present.

The same result is deducible if we regard Fig. 1 as a plan instead of an elevation. The machine will not be heard until it is directly abreast of the observer, namely, until it reaches the point D.

It is, of course, immaterial whether the machine actually starts at A or whether this point is regarded as that at which a stationary source of sound would be just audible to an observer at B. It is impossible to state or describe what the noise effect as the machine passed from D to E would be like, except that it would be a roar increasing with great suddenness from silence at D to a maximum intensity when the machine was at E. If, instead of a confused noise, the machine emitted a musical note, there would be an intense manifestation of the Döppler effect during the interval occupied by its flight from D to E.

Fig. 2 illustrates the case of a machine flying—as is now possible—at half the speed of sound. The noise emitted at A is not received at B until the machine is at C. If A B is the limit of audibility of a stationary noise, the machine will be inaudible until it is at C; that is, until it is at a distance equal to half the audibility range from the observer.*

In both these cases, it should be noted, the noises received by the observer's ear are unique in the sense that the noise received at any instant is the noise emitted by the machine at a *single* point on its path. This uniqueness does not, however, hold good if the machine is travelling at a speed in excess of the velocity of sound. Fig. 3 illustrates this case for a machine flying at twice the speed of sound. Here A C is equal to twice A B, and hence the machine starting at A will not be audible to an observer at B until it reaches the point C. When it reaches C the sound which it emitted at A will just be arriving at B. It is, however, possible to find another point F on X X, such that F C is equal to twice F B. Hence, when the machine reaches C the sound which it emitted at F will just be arriving at B. It is clear, therefore, that the sounds emitted by the machine when it was at A and F arrive at B simultaneously, namely, at the instant when the machine is at C. As the machine proceeds beyond C there will always be two other points A′ F′, the sounds emitted at which will be received simultaneously at B.

If these super speeds are ever realised—Monsieur Blériot encourages us to believe that they are not impracticable—Dover will still be able to warn London that a hostile aeroplane has passed overhead, but the first sound London will hear will be the explosion of the bombs. Sound locators will be valueless as a means of detecting the approach of a raider.

Apart from this disquieting reflection, the subject can be given a turn of intense interest if for the aeroplane we substitute a body emitting light, and recast the problem in terms of visibility instead of audibility.

London, October 7th. S. F. C.

SIR,—In your issue of October 4th "Summit" asks what the sound effect would be on an observer's ear of the loud exhaust noise of an aeroplane approaching him in a straight line at the speed of sound.

So far as the human ear is concerned, there will be no perceptible sound from the machine while it is approaching the observer as it "keeps up" with the sound it emits.

Regarding solely the sensory side of the ear system, as the upper limit of normal audibility does not exceed 20,000 vibrations per second, the ear will not hear any sound just when the machine is passing it. But there has to be considered the possibly destructive physical effect on the delicate leverage and fabric of the ear caused by the resonant vibrations set up at that moment. The observer will hear—or should we say feel?—instantaneously the tremendous accumulation of sound of extremely high frequency, technically termed the ondé-shock, which will arrive at the same time as the aeroplane.

Once the machine has passed the observer, the sound reaching his ear will have a note an octave lower than the actual note emitted by the exhaust. This is, of course, the Doppler effect.

J. S. BOYD.

Grangemouth, October 9th.

THE MECHANICAL EQUIVALENT OF HEAT AND THE LAW OF CONSERVATION OF ENERGY.

SIR,—Mr. R. W. Bailey's address to the Institution of Mechanical Engineers—your issue June 28th last—is likely to become a standard work of reference for historians of mechanical science.

For this reason, and without wishing to detract from anything said of Joule's own work, I venture a plea, even at this late date, for recognition of the work of the Frenchman Seguin and the Englishman Grove in the same field.

Two years ago, when staying at Marc Seguin's old home near Annonay, his grandson, Monsieur Laurent Seguin, gave me a French edition of Grove's "Correlation of Physical Forces," with notes by Marc Seguin, at whose instigation the translation had been made.

It seems clear that Seguin was prior to Joule in seeking and determining a mechanical equivalent for heat, and that in relation to the doctrine of the conservation of energy Grove has never received—except from Seguin—due credit for his thesis on the correlation of physical forces.

Seguin's claim is admitted in the article on "Energy" in "Encyclopædia Britannica," eleventh edition, but generally ignored by English writers.

Grove is perhaps still mentioned as the inventor of the battery which bears his name, but his far greater and more comprehensive scientific work is generally unknown.

"Réclamations de priorité," as Sir William Grove called them, have, I know, too often poisoned the wells of history. His unpublished memoirs—to which I have been given access by the kindness of his grandson, Major J. W. Hills—show that Grove's own personal dislike of such claims restrained him from public objection to those which were made on behalf of Joule with regard to the doctrine of the conservation of energy.

It is, however, unnecessary to rely on any *ex parte* statements by the one side or the other. The publication dates of Grove's lectures and writings speak for themselves. Some biographical notes on Grove and his work will be found in *Nature*, 1896.

Regarding Seguin's work, reference must be made to his own book "Sur l'Influence des Chemins de Fer," published in 1839. There is also a letter of his published through Sir David Brewster in the *Edinburgh Review*, 1824, which, I gather, bears on the theories of conservation of energy, or correlation of physical forces, as foreshadowed by the ideas of Montgolfier, an uncle of Seguin, who later strove hard for their recognition.

Unfortunately, the *Edinburgh Review* is at the moment out of my reach, and I quote the letter with due reservation and merely to interest others who may be studying the history of the scientific developments of a hundred years ago. Some biographical notes on Marc Seguin are given in your issue of June 24th, 1927, under "Centenary of the First Railway in France."

J. G. H. WARREN.

Bath, September 29th.

PHYSICAL PROPERTIES OF "ALDREY."

SIR,—In the report of the Institute of Metals meeting in your columns of September 27th, the abstract of the paper by Drs. Zeerleder and Bourgeois states that the aluminium alloy "Aldrey" "is capable of age hardening in such a manner that, while its tensile strength is very considerably increased, the electrical conductivity is relatively little impaired." This statement, which does not come from the original paper, is apt to lead to a misapprehension of the special qualities of this wire alloy. What actually happens is that the rolled rods are not much harder or stronger than pure aluminium, but after normalising and drawing to the finished size, the tensile strength rises to nearly 29 tons per square inch, and the conductivity is around 25 on the international scale, copper being 57, which means that the electrical resistance of 1 m. length of annealed copper wire 1 square millimetre in area is $^1/_{37}$ ohm. The final heat treatment of the wire can hardly be termed "age hardening," when the annealing reduces the tensile strength to 20 tons per square inch, the elongation rising from 1 to over 7 per cent. on 10 in., and the electrical conductivity is not "impaired," but actually increased to 32, thus bringing it up to over 50 per cent. that of hard-drawn copper and over 90 per cent. that of pure aluminium.

J. S. P.

Warrington, September 28th.

VIBRATION ON LARGE PASSENGER LINERS.

SIR,—In THE ENGINEER of September 27th a printer's error occurred in the report of the remarks I made during the discussion of Messrs. A. T. Wall and Ashby Tabb's paper entitled "Ship Design and Arrangements from the Passenger's Point of View," read before the Institution of Naval Architects' summer meetings in the Capitoleum at Rome. The words "critical excentricity" appeared twice in this report, which ought to have read "initial excentricity." It was intended to convey that at the critical whirling speed of a rotor the merest trifle of initial excentricity suffices to maintain great whirling motion.

To this conclusion two limitations must be added: (1) The influence of friction may limit the whirling that can be maintained, although seldom to a safe value; and (2) although a trace of excentricity may maintain dangerous vibration when such vibration has been produced, a considerable time may be required to produce it if the shaft is not otherwise disturbed. For these reasons it is not generally unsafe to run through the critical speed if a shaft is well balanced statically.

The practical importance of static balance is largely due to the way in which any initial excentricity of the rotor is magnified by the elastic flexure of the shaft. When a high operating temperature is used this matter requires special attention, because shaft flexure increases appreciably as the temperature rises.

London, October 10th. W. HAMILTON MARTIN.

MAIN LINE ELECTRIFICATION.

SIR,—Weighing your apt reference to the present position between the claims for stationary train operation by electrical power and the claims for mobile units, which once again raises a controversy that was settled at the Rainhill trials for a hundred years, is it not possible that a happy compromise might be effected by the development of the Diesel-electric and turbo-electric locomotive, combined with a third-rail compensating system, into which each unit might turn its surplus power at any given moment, for the benefit of the whole system?

Such a system would, at first blush, appear to have much in its favour, independence of train units would be assured, transmission losses would be cut to a minimum, increased reliability against breakdown even on steam locomotive power would be secured, and no drastic capital outlay would be called for, as in the case of a wholesale conversion, since such locomotives could be constructed to compete with existing conditions on existing steam lines and the third-rail system developed gradually as funds permitted.

There are probably technical problems involved which escape the writer, but the importance of retaining independent mobility of units from the civil and military point of view cannot be over-estimated, and if the benefits of electrical traction can be secured without the drawbacks of power centralisation, which are very real, then much would be gained.

S. P. CHRISTIE.

Starcross, South Devon, October 9th.

SUPERHEATERS AT LANGERBRUGGE.

SIR,—With regard to the article published in your issue of September 6th this year, headed "Modern Steam Pressures and Temperatures," we think it desirable to draw your attention to the statement therein as to the carbon content of the tube material supplied in the superheaters at Langerbrugge. It is there stated that the carbon content of these tubes was about ·08 per cent., whereas in reality these tubes have a carbon content of between ·12 and ·14 per cent., which, you will readily realise, constitutes a material having quite different properties from those to be expected with a carbon content as low as ·08 per cent.

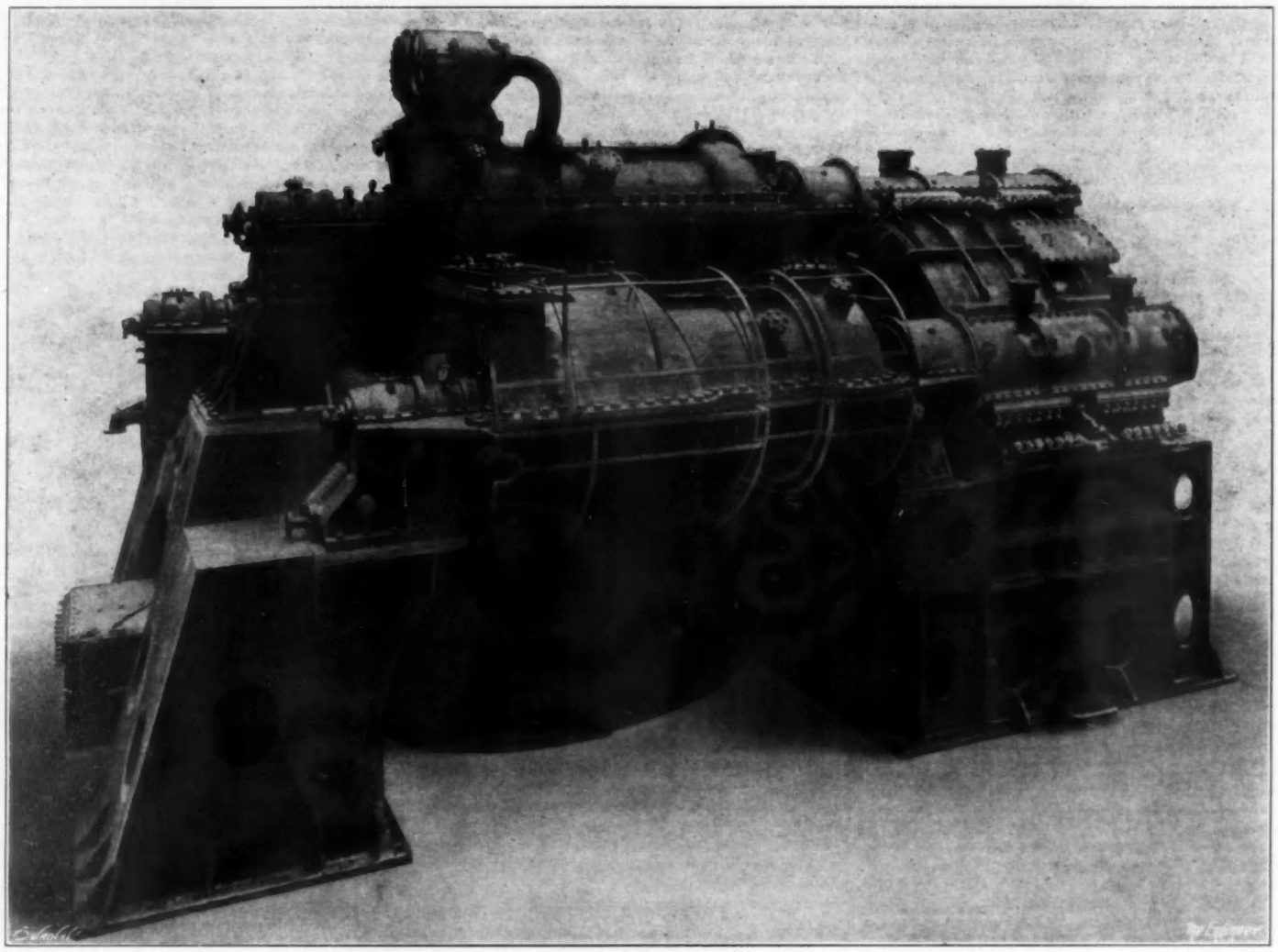
BABCOCK AND WILCOX, LTD.,
London, October 5th. C. H. DAVY.

IN the issue for September 14th of the *South African Mining and Engineering Journal*, there was started a serial reprint of the account, written by Doctors A. Bancroft and R. A. Pelletier, of the geology of Northern Rhodesia.

* This inaudibility effect was quite noticeable to a representative of this journal on Ryde Pier during the Schneider Trophy Race. From Cowes to Ryde is five sea miles. Yet the machines were quite silent until they were well within half that distance from Ryde.—ED. THE E.

THE 13,000 S.H.P. STARBOARD TURBINE UNIT OF THE "EMPRESS OF CANADA"

THE FAIRFIELD SHIPBUILDING AND ENGINEERING COMPANY, LTD., GOVAN, GLASGOW, ENGINEERS



The Re-engined Canadian Pacific Liner "Empress of Canada."

The recent additions to the fleet of Canadian Pacific Steamships, Ltd., and the improvements in the acceleration and luxury of the company's steamships engaged in the Atlantic services between Canada and this country which took place with the introduction of the new "Duchess" class of geared turbine-driven steamers have been the forerunners of a similar improvement in the company's Pacific steamship services between Vancouver, Yokohama and Hong Kong.

The "Empress of Japan," which is now being built by the Fairfield Shipbuilding and Engineering Company, Ltd., for the above-mentioned route, will, when completed, be the most luxurious vessel on the Pacific, with a speed of 22 knots, which speed is a considerable increase on the speed of any of the existing vessels on the Transpacific service.

The "Empress of Canada," completed in 1922 by the Fairfield Shipbuilding and Engineering Company, Ltd., for the same owners, is an ocean liner of the highest class, but the speed of 19 knots for which she was originally designed was not sufficient for the new accelerated programme. The experience gained with the "Empress of Australia" after the installation of new single reduction geared turbine machinery using a high degree of superheat —see THE ENGINEER, June 17th, 1927—showed that with increased shaft horse-power a radical reduction in the daily fuel consumption, together with increased speed, can be obtained. As a result of this experience, Canadian Pacific Steamships, Ltd., decided in the case of the "Empress of Canada" to remove the original propelling machinery, which was of the double-reduction geared Brown-Curtis type, using saturated steam, and to install in its place single-reduction geared turbines of the most modern Parsons type, using superheated steam and capable of developing 40 per cent. more shaft horse-power than was possible with the original machinery.

The contract for the conversion was placed with the Fairfield Shipbuilding and Engineering Company, Ltd., which company, it will be recalled, also carried out the conversion of the machinery of the "Empress of Australia" for the same owners about two years ago.

In the "Empress of Canada" the original cylindrical boilers are retained, as they were designed with dimensions of ample size and were shown to be capable of providing, with a good margin, the whole of the steam now required for the increased shaft horse-power with the more economical design of turbines which have now been installed.

The conception of these alterations is the work of Mr. J. Johnson, the chief superintendent engineer of Canadian Pacific Steamships, Ltd., under whose personal supervision the whole work has been carried out. The vessel has now returned to service, and again the results have fully justified Mr. Johnson's bold ideas in striving to obtain the greatest overall economy or, perhaps more correctly stated, the final decimal point in fuel consumption. It was decided to retain the tunnel and thrust shafting as originally fitted, but the propellers, which were of the built type, were replaced by new propellers of the solid type, cast in manganese bronze and designed to suit the increased power, revolutions and speed.

Twin sets of new turbines with single-reduction gearing were constructed by the Fairfield Company and installed to suit the original lines of shafting. The starboard turbine unit is shown above. Each set of turbines consists of one H.P. ahead, one I.P. ahead, and one L.P. ahead turbine, each driving the main gear wheel through an independent pinion. The L.P. turbine is of the double-flow type and an H.P. astern and an L.P. astern turbine are incorporated in the casings of the I.P. and L.P. ahead turbines respectively. Attention may be called to the very massive turbine and gear case base-plates which, bolted directly on to the tank top, give great rigidity and steady running. The designed service output of the installation is 26,000 S.H.P. with a maximum output of 29,000 S.H.P. Arrangements are made so that in case of necessity any one of the ahead turbines may be readily withdrawn from service and the voyage continued with the remainder of the turbines in use.

New condensers of the Weir regenerative type, with cupro-nickel tubes, together with new air pumps of the Weir "Paragon" type, were fitted, these being designed to ensure the installation being capable of maintaining a high vacuum in tropical waters.

The original feed heating arrangements consisted of a low-pressure surface heater taking exhaust steam from the reciprocating auxiliary machinery and a direct contact heater supplied with exhaust steam from the turbo-generators. The feed temperature available from these heaters averaged 225 deg. Fah. An additional high-pressure surface heater has been fitted on the feed pump discharge, for which steam is bled from an appropriate stage of the H.P. turbines and the feed temperature is thus raised to 300 deg. Fah.

The boilers which supply steam for the main engines have been fitted with superheaters of the smoke-tube type, supplied by the North-Eastern Marine Engineering Company, Ltd. These superheaters have an unusual feature, which has been developed by Mr. Johnson in conjunction with the makers, namely, in that the top rows project into the combustion chambers 9in., the projection gradually decreasing to 4in. at the bottom. The installation is designed to give a steam temperature of 650 deg. Fah. at the superheater outlet.

As a further aid to economy two generators, each of 210 kW output and driven by oil engines made by W. H. Allen, Sons and Co., Ltd., have been installed. These generators are together capable of supplying the current necessary for the total requirements of the vessel. The original generators, driven by steam turbines, have been retained for stand-by purposes.

In order to comply with the most recent Board of Trade requirements, there have been fitted a new emergency bilge pump, two emergency oil-engine generator sets, and the Lux-Riche system for fire extinguishing is installed throughout the boiler rooms, and new motor-driven sanitary pumps have also been added.

The vessel recently completed her trials with the new machinery on the Clyde, with very satisfactory results. An average speed of 22·4 knots was obtained during the runs up and down the Arran measured mile, which, compared most favourably with the maxmum speed of 20 knots when the ship was originally built. Notwithstanding this greater speed, the fuel consumption has been considerably reduced. Formerly, when on the Pacific service, the maximum speed obtained was, under the most favourable conditions, 20·6 knots on a consumption of 284 tons of oil fuel per day. Since her conversion the "Empress of Canada" has made a westbound Transatlantic passage at an average speed of 20·53 knots on a daily consumption of 175 tons of oil fuel per day, the displacements on the Pacific and Transatlantic voyages being approximately the same. During this first voyage the machinery was run under easy conditions. In due course, after the gears have been "run in," the power and speed will be increased.

THE INSTITUTION OF CIVIL ENGINEERS: AWARDS.—The Council of the Institution of Civil Engineers has awarded the Indian Premium for session 1928–29 to Mr. H. N. Colam, B.A., Assoc. M. Inst. C.E. (Simla) and a Webb Prize to Mr. C. Gribble M. Inst. C.E. (London). They have also made the following awards for session 1928–29 in respect of selected engineering papers published without discussion:—Telford Premiums to Messrs. H. Chatley, D.Sc., M. Inst. C.E. (Shanghai); E. B. S. Powell, Assoc. M. Inst. C.E. (London); R. D. Gwyther, M.C., M.Sc., M. Inst. C.E. (Jersey); R. D. Brown, M. Inst. C.E. (Manchester); E. Parry, B.Sc., M. Inst. C.E. (London); A. B. Miller D.S.O., M.C., M.Sc. (Weybridge); G. B. R. Pimm, Assoc. M. Inst. C.E. (Bristol); W. H. Clark, M. Inst. C.E. (Johannesburg); and F. W. H. Downing, B.Sc., Assoc. M. Inst. C.E. (Bombay); and in respect of papers read at students' meetings in London, or by students before meetings of local Associations during the same session:—The James Forrest Medal and a Miller Prize to Mr. L. S. Sanson, B.Sc., Stud. Inst. C.E. (Glasgow); and Miller Prizes to Messrs. V. G. Pickering, Stud. Inst. C.E. (Manchester); E. T. Crowe, B.Sc., Stud. Inst. C.E. (Cardiff); E. C. Pound, B.Sc., Stud. Inst. C.E. (London); I. W. G. Freeman, B.Sc., Stud. Inst. C.E. (London); H. W. T. Perkins, M. Eng., Stud. Inst. C.E. (Sheffield); C. W. N. McGowan, B.A., Stud. Inst. C.E. (Manchester); R. E. R. Hammond, Stud. Inst. C.E. (London); and James Arrol, Stud. Inst. C.E. (Glasgow).

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Birmingham Quarterly Meeting.

The autumn quarterly meeting of the Midland iron trade, held in Birmingham to-day—Thursday—was a somewhat tame affair, and disappointing from a business production point of view. There was a moderately good attendance, representatives being present from most of the districts interested in this market, but apart from the query as to what might happen in the finished iron department regarding price alterations, little was anticipated to develop at the meeting which would have a serious effect upon business during the current quarter. Raw iron and finished steel prices had already been fixed, and it was felt that a large proportion of the business available to the end of the year, in so far as purchases of raw material were concerned, had been given out before the meeting; consequently, there was little to hope for in the way of big orders. The possibilities of a rise in finished iron prices have been fully discussed for some weeks now, and speculation was rife in the early stages of the meeting as to the probability of ironmasters passing on to the consumer some part, at any rate, of the increase in production costs lately brought about by dearer raw material. At the time of writing, however, no increase had been announced. Conversations for the most part related more to trade prospects in general than to the buying and selling of iron and steel, and the prevailing, or perhaps it would be more correct to say, the predominant opinion was one of hopefulness, if not exactly of optimism. Engineers and manufacturers in some branches of industry were almost elated with the immediate outlook, but there were others engaged in different departments of trade who were either sceptical or frankly discouraged. The trouble at the moment seems to be the irregularity and uneven distribution of business. On the whole, one might safely assert that it is better in the heavy industries in this area than it has been, the improvement having been fairly general in the basic industries, but confined to certain branches in the engineering and manufacturing trades. While structural engineers, who have been having a very quiet time of late, to-day reported improving symptoms, makers of heavy edge tools and producers of bolts and nuts in the Black Country deplored a position going from bad to worse. The automobile industry is between the seasons, but here there are evidences of a growing demand, and of a new season ahead in which agents claim that they will be able to dispose of increased numbers of vehicles both heavy and light. In the commercial section and transport branches of the industry this district is going ahead, and, failing Government interference with existing trading conditions, a really active and successful future is in prospect. This industry should consume large quantities of steel in the near future, while many Midland manufacturers should be called upon to supply fittings and accessories. The remaining months of this year should, all being well, be months of considerable activity, and the improved momentum which industry in this area has taken on during recent months should be upheld, if not materially increased.

Finished Iron Prices.

The increases in production costs of finished iron of late have been such that consumers have been looking for a readjustment of prices. Some surprise has been expressed that ironmasters have not previously put up selling rates, for it was realised that the additions to their production costs since prices of iron were last fixed have been heavy. Speculation as to how long present prices would be permitted to stand, and how long ironmasters would bear the whole of the increases has been general, and in many circles the announcement of an advance at to-day's quarterly meeting of the iron trade was expected. Users had therefore for some weeks past been buying more than their actual requirements justified, being satisfied that it was a wise policy to put some iron into stock. Others had taken the precaution to place contracts covering their needs to the end of the year. Staffordshire makers of marked bars who have been doing quite well during the past quarter were disinclined to take any action which might have the effect of interfering with the improving trade tendency, and, accordingly, they refrained as long as possible from disturbing selling prices. It has to be remembered, however, that while demand for best grade bars is brisk, second and common grades of iron are not in such a healthy state, and any addition to selling prices in these departments would almost certainly result in increased business going to Staffordshire's competitors. Throughout the past quarter makers of Crown bars in other districts have been offering supplies on the Birmingham market at prices considerably below those of local makers, and they have been taking perhaps the lion's share of the available business. District makers have only been enabled to keep going by preserving the quality of their product, and there has been some talk of setting up a standard of quality for Crown bars. If this were done, Staffordshire makers feel they would be able to secure much more business. The Crown bars now being sold here in competition with local makes are inferior in quality, it is affirmed, and hence the difference in selling prices. In the common bar branch the foreigner has for months past dominated the market. Belgian No. 3 iron used for bolt and nut making has been procurable at rates which have left Staffordshire bar iron makers gasping. It has been absolutely impossible to compete in this branch, and the foreigner has undoubtedly had it all his own way. Any advance in local iron would make the price disparity larger, but it would have no material effect upon the market. Ironmasters re-rolling steel have been, and are, busy competing very successfully with the steel works. The demand for wrought iron tube strip keeps up well, and makers have no difficulty in getting £11 2s. 6d. per ton for their output. It is hoped that the current quarter will see a further advance in the fortunes of this branch of the iron trade.

LATER.

Since writing my letter the ironmasters concerned in the Staffordshire marked bar industry have made the anticipated move mentioned therein, and have advanced the selling price 10s. per ton. The new selling figure becomes £12 10s. at makers' works. The marked bar standard has remained stationary at £12 since April, 1928, despite a considerable appreciation in raw material costs. Crown and nut and bolt bar prices will doubtless move in sympathy in the course of the next day or so. It has been felt for some weeks now that ironmasters could not continue much longer to bear the full burden of the increase in production costs, and the market was prepared for the advance now made.

Raw Iron.

The pig iron department was quiet on 'Change to-day. There has been ample excitement in this branch of the market during the past quarter, prices having advanced again and again as fuel costs have appreciated. Smelters have been in a firm position, and they have not hesitated to push it home. Demand in the foundry department has kept abreast of supply, and smelters have never had cause to fear for their production. In the forge branch, business has not been so good, but considerable sales have been effected, and there has been an occasional small buying spurt. It has been felt that prices of forge iron ought not to have been put up to the same extent as foundry grades of iron, but smelters have so far not been able to see their way to give special concessions to the forges. Now that prices have been settled for the time being, business is proceeding normally, but it is on rather a small scale, many consumers having bought well before the last advance, which had been anticipated for a week or more. It was realised that with fuel prices advancing against them, smelters would have to seek self-protection in higher selling prices, but now they are somewhat concerned as to the effect of, at any rate, the latest price advance. A revival in demand has been discernible in the foundry iron trade lately, and in some quarters a sharp reversal of the position is predicted. At date, though buying is slow, furnacemen are in a strong position, and have no difficulty in disposing of the whole of their output. Indeed, some furnaces are assured of a market for their output to the end of the year. In these cases, specifications are coming in regularly for delivery against contracts. For No. 3 foundry iron of Derbyshire make, £3 18s. 6d. per ton is now being paid, and for Northamptonshire £3 15s. delivered to stations in the Black Country. Forge sorts sell at 4s. per ton less in each case. West Coast hematite prices have been strengthened. East Coast makers now quote £4 10s. 6d. to £4 11s. 6d. for mixed numbers delivered Birmingham, which represents about £3 14s. 6d. to £3 15s. 6d. at furnaces, an appreciably higher price than they were getting a month ago. The quarterly meeting brought no great accession of business to the pig iron trade.

Variable Steel Demand.

Demand for finished steel continues irregular, and while, on the whole, business is good, there are some departments in which only a moderate demand exists. The steel works in this district have during the past quarter gradually improved their position until at date output is regular and fairly heavy. Steel masters claim to be holding their own against the foreigner, and generally speaking they are satisfied with the results of their offer of special terms to users of British material only. They assert that, last quarter at any rate, it paid users of finished steel to participate in the scheme. Continental finished steel prices have been only barely competitive, and when delay in deliveries and other adverse factors are taken into consideration, purchases of foreign material have not proved worth while. Steel prices during the quarter have remained very firm, and the Association has on more than one occasion surprised consumers by reaffirming prices instead of increasing them, as had been fully expected, owing to increased production costs. On 'Change in Birmingham to-day, Staffordshire steel hoops were quoted £10. Angles and joists are £8 2s. 6d.; ship, bridge and tank plates, £8 17s. 6d.; boiler plates, £8 12s. 6d. In the half-products department the fight for supremacy between native and continental mills continues. Just now prices of British semis are upheld with difficulty in face of the low figures quoted by continental shippers. Local rollers quote small bars from £8 2s. 6d. upwards, and billets vary between £6 7s. 6d. and £6 1s. 6d. Continental quotations for these materials vary almost daily. Birmingham merchants claim to be securing a larger percentage of the business in steel bars. One thing is certain, more of this foreign material is coming into the Black Country than was the case a month or so ago. Steel masters at to-day's quarterly meeting spoke hopefully of business prospects to December 31st. They would much appreciate, however, a larger demand for structural steel.

Galvanised Sheets.

No improvement is discernible in the galvanised sheet industry, and market conditions in this department are decidedly slow. Neither home nor export buyers seem to be in need of supplies, and manufacturers' order books are getting thin. Mill owners see no probability of increasing turnover by reducing selling rates, consumptive demand being absent. They therefore adhere to the recent selling basis of £13 7s. 6d. per ton for 24 gauge corrugated sheets. As pointed out last week, there are mills so fortunately placed that they would not accept orders at £13 7s. 6d., even if they were offered. These makers ask up to £13 15s. per ton for their output. Some revival of export buying would be very welcome just now, and makers hereabouts are anxiously scanning the horizon for signs of an awakening of demand in any of the chief overseas buying markets.

Fuel.

Furnace coke continues difficult to obtain and prices remain high. Smelters seeking supplies on the open market this week were pretty generally asked 18s. 6d. per ton at ovens. Coke makers predict still further advances in price before the end of the year. They certainly hold the whip hand at present, and are determined to retrieve some of their past losses. Midland blast-furnacemen say that there is little likelihood of further furnaces being brought into operation in this area until there is an improvement in the fuel position.

Ironworkers' Wages.

Midland ironworkers' wages during the next two months will be calculated on the basis of 30 per cent. above the 1911 rate of 13s. 6d. This is an advance of 2½ per cent. and is the result of the upward movement in selling prices of iron during the last few months. Wages are based on a sliding scale, under the Midland Iron and Steel Wages Board, which conforms with selling prices in the previous two months, an arrangement which works very satisfactorily here. It is interesting to recall that on the occasion of the October wages pronouncement last year wages were reduced by 2½ per cent., bringing them from 30 per cent. to 27½ per cent.—just a reversal of the position as it occurs this year.

New Works at Dursley.

I am given to understand that R. A. Lister and Co., Ltd., of Dursley, Gloucester, have decided to erect a new factory in which work will be carried out on mass production lines to supplement their existing facilities. This has become necessary to enable the firm to cope with the orders received by it from abroad. Several new machine shops are also to be built. The estimated cost of the works is in the neighbourhood of £100,000, and they will cover an area of 100,000 square feet.

Cannock Chase Coal Losses.

There was a loss of ·066d. per ton on all coal raised in the Cannock Chase and Pelsall coalfield during the month of August. The ascertainment of miners' wages for October based on the working of the industry for the past three months, results in wages remaining at the minimum rate of 42 per cent. above the 1911 basis, giving stallmen a wage of 9s. 4d. per day. The ability of the industry to pay, however, is only 13·11 per cent. The owners' accumulated deficiency now stands at well over £1,000,000.

Obituary.

I regret to record the death at the age of fifty-one of Mr. William Somers, who was for many years actively associated with the iron and steel trade in this area. Mr. Somers was the third son of the late Mr. Walter Somers, the founder of Walter Somers and Co., Ltd., of Haywood Forge, Halesowen, near Birmingham. He was a director of that firm for a long period, but left Halesowen some years ago.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Exports and Rationalisation.

Opposition from Lancashire textile engineers to the proposal to form a Textile Machinery Union, put forward by Mr. M. C. Harman, chairman of John Hetherington and Sons, Manchester, shows no sign of diminishing. Mr. W. Davidson, chairman of Tweedales and Smalley, Ltd., Castleton, says that his company has no use for rationalisaton, if by the term it is meant that it is expected to give up all the advantages that it as a firm holds and join hands with firms less favourably situated than itself. If textile machinery prices were unduly raised in consequence of an amalgamation of firms engaged in the industry, the effect, in Mr. Davidson's opinion, might easily be to check some, at least, of the country's export trade in this branch. He adds that any reasonable scheme for amalgamation or merger that was put forward for the betterment of the trade would be carefully considered. For the last five years the ordinary shareholders in Tweedales and Smalley have received a dividend of 15 per cent., and an interim distribution at the rate of 7½ per cent. in respect of the current financial year has just been declared.

The Engineering Position.

The position in the engineering industries of Lancashire is reviewed as follows in the monthly record of the Manchester Chamber of Commerce:—When the cotton mills were closed owing to the wages dispute, millwrights got a quantity of overhauling to do. The textile machinery trade, however, is still very dull so far as home orders are concerned. The overseas demand for spindles and looms has been about the same as usual. The total value looks large, but it is not sufficient, while home business is slack, to keep all the textile machinists fully employed. Constructional engineers have had a good deal of work on hand in the last two months, but orders are running out faster than new ones are coming in, as might be expected at this time of the year. Locomotive builders have had a succession of orders, and electrical engineers have generally been busy, but boiler makers and colliery engineers have had a lean time. Machine tool makers continue, as a rule, to do quite a good business.

The Lake District Looks Askance.

Protests from the Lake District against the use of overhead cables in the area in connection with the South-East Lancashire power scheme have been numerous of late, but they are likely to be overruled. The matter came before the members of the South-East Lancashire Electricity Advisory Board at a meeting in Manchester, and it is understood that a resolution embodying the view that overhead cables are essential to a cheap supply of current has been forwarded to the Central Electricity Board. If underground cables were adopted the heavy additional cost would, it is asserted, have to be borne by consumers within a 25-miles radius of Manchester, the charges for current being estimated at about 12 per cent. more per unit than if overhead transmission were adopted. The probability is that much as the Lake District seems to dislike the idea of pylons it will, for economy's sake, be compelled to adapt itself to them.

Keeping Work in Lancashire.

The Manchester Tramways Committee seems to be meeting with one rebuff after another in its attempt to substitute motor-omnibuses for electric tramcars on a circular route in the suburbs. When the matter was first brought before the City Council it was referred back for further consideration of ways and means, many members urging that the purchase money should be taken from the reserves of the undertaking instead of being raised by means of a loan, as was suggested by the Committee. This point was eventually settled, and the latter course decided upon. Now, when the Committee gets to the stage of recommending to the City Council the allocation of the contracts, more trouble arises. Its plan was to divide the order for the chassis for ninety omnibuses between Crossley Brothers, Ltd., Manchester; Leyland Motors, Ltd.; Leyland, near Preston; and the Associated Equipment Company, Ltd., Southall. Principally on the ground that the work should be retained in Lancashire, an amendment instructing the Committee to divide the proposed order to the Associated Equipment Company between the two other firms was carried by a large majority. One speaker rather naïvely suggested that at a time when so much was being said about the exodus of industrial firms to the south it would be folly not to keep the work in Lancashire.

Electricity Schemes.

Buxton Borough Electricity Committee has obtained the sanction of the Electricity Commissioners to borrow £9842 for electric city mains and services. The Electricity Committee of Leigh has adopted a scheme, at an estimated cost of £6929, for laying conduit lines and cables, and providing a sub-station and transformer equipment for electricity supplies in West Leigh and Pennington.

Obituary.

Alderman H. N. Bickerton, founder and managing director of the National Gas Engine Company, Ltd., Ashton-under-Lyne, died on Sunday at Thorneycroft Hall, Siddington, Cheshire, at the age of seventy-two.

Non-ferrous Metals.

One of the principal features of the market for non-ferrous metals during the past week has been a further serious relapse in tin, the latest decline bringing it well below the vital £200 mark again, after it had been consistently above it since early in June. As a matter of interest, it may be recalled that at the beginning of last December values were more than £40 per ton higher than those current to-day. Heavy stocks of the metal are in sight, and bearish influences have had much to do with the decline during the past week. Whether it will continue or not remains to be seen, but buyers are exercising caution. Copper, on the contrary, has, after a series of ups and downs, more than recovered the ground lost a week ago, although there has not been a great deal of activity so far as standard brands are concerned. Cable manufacturing interests, however, have being purchasing pretty freely again. The demand for lead has been on quieter lines, and prices have weakened to the extent of 2s. 6d. to 5s. per ton. Spelter has been the subject of rather more inquiry than of late, and the decline that has persisted during the past month or so appears to have been stemmed for the time being, values, on balance, being higher by about 2s. 6d. per ton.

Iron and Steel.

There has been little in the way of development on the iron and steel markets during the past week, although firmness continues to be pretty general so far as home-produced materials are concerned. Deliveries of foundry iron from the Midlands to Lancashire users are maintained at a satisfactory level, but the lull in new buying continues. For delivery to users in Manchester, Staffordshire and Derbyshire makes are quoted at 77s. per ton, Scottish at about 93s., and hematite iron at up to 90s. per ton Bar iron is in moderate request, and extremely firm at £10 15s. per ton for Lancashire Crown quality. At the moment the demand for deliveries of constructional steel materials is rather slow, but inquiries for locomotive plates are persistent, with, however, general plates mainly moving in small day-to-day parcels. A quiet business is reported here in the case of small re-rolled bars, quotations for which range from £8 5s. to £8 10s. per ton, according to quantity. Other prices in the home steel section are firm at £8 2s. 6d. per ton for joists, £9 17s. 6d. for boiler plates, £8 17s. 6d. for general plates, and £9 2s. 6d. for large bars. More inquiry for foreign steel has been in evidence, and under the weight of keen competition there has been a further formidable fall in values. Continental billets are now obtainable at from £5 7s. 6d. to £5 9s. per ton, according to size, sheet bars at about £5 9s., angles at from £6 7s. 6d. to £6 12s. 6d., joists at £6 5s., and wire rods at £6 17s. 6d. per ton, including delivery to Lancashire works.

BARROW-IN-FURNESS.

Hematite.

Iron producers are now in a better position, for the stiffening prices gives them a little margin of profit on their production. This increase in price is also evidence of the better state of the trade. Most of the orders which are being booked now are for forward delivery and there is very little iron available for prompt delivery, unless previously secured. The general tone in the market is better than it has been for some time, and makers are booked forward well into next year. Business in special qualities continues to be good, and makers are well booked up in that class of iron. Continental business is steady, but American is inclined to fluctuate. With the home demand so steady there is not much chance of heavy shipments to America, especially if the demands on steel account are steady. Iron ore is in slightly better demand from smelters outside this district. Local demands are steady and not likely to increase unless more furnaces are put in blast. Foreign ore is in steady demand. The steel trade is only moderate, but the Barrow mills are working again on rails, &c., and there is a chance of them being kept going for a time. It is too early yet to indulge in any optimism as regards the steel trade, for competition continues to be very keen, especially on any orders which aggregate fairly heavy tonnage. The hoop mills are better situated, and are well fixed for contracts, mostly on overseas account.

SHEFFIELD.

(From our own Correspondent.)

Dullness in General Steel Lines.

ALTHOUGH the basic steel furnaces are still well employed, especially in the North Lincolnshire district, there are many poor patches in the steel trades of Sheffield. The acid side of production keeps at a low level, and there is a good deal of short-time working at the plants devoted to that material, at the mills, and the forges. The demand for railway material shows little improvement. Although orders from the British railway companies for axles, tires, and springs come to hand with fair regularity, the amount of work placed is below the normal standard, and is quickly disposed of by the greatly extended plants which the city now possesses. Trade with overseas railways is on a meagre scale. During recent years a considerable amount of work in that department, which formerly came to Sheffield, has gone to Belgium and other continental countries. In general lines of steel manufacture trade is flat, and, while it is believed that much work is likely to be placed in the near future, the prospects of immediate improvement are not bright. There is much shortage of work at the private wagon-building shops.

Some Brighter Spots.

The departments dealing with special steel products are much more favourably placed. Good progress is reported in the alloy steel branch. These steels are replacing ordinary kinds to a large and growing extent. Sheffield's capacity to supply them is unequalled, and firms which specialise in their production are very favourably situated. The motor and aircraft industries continue to make large demands upon Sheffield for special steels and parts, and there is a well-sustained trade in stainless, non-corrodible, and heat-resisting steels. The old firm of Kayser, Ellison and Co., makers of aircraft and motor steels, tool steels, and other lighter products, had a record in output and sales during its last financial year, and, at the annual meeting last week, the chairman reported that this year's sales were showing a further slight advance.

Works Gains and Losses.

It is pleasing to be able to report that extensions of works are in progress in the city and district. New rolling mills are being erected at the North British Steel Works of George Clark, Ltd., Sheffield, and considerable extensions are also being carried out at the Park Gate Iron and Steel Works. On the other hand, rationalisation is to be responsible for the closing of another of the works of Cammell, Laird and Co., Ltd., one of the firms forming the English Steel Corporation. Their steel foundry at Grimesthorpe, Sheffield—an up-to-date establishment, which was reconstructed and enlarged about three years ago—is to be closed. The process will be carried out gradually, with a view to enabling the displaced men to be absorbed by other works.

A Combination.

It is announced that the centrifugal castings business of Newton, Chambers and Co., Ltd., Thorncliffe Ironworks, near Sheffield, is to be combined with that of the Sheepbridge Stokes Company.

Pithead Gas and Electricity.

The South Yorkshire Coalowners' Association is strongly advocating the public use of gas and electricity produced at the pithead. It has recently entered upon a publicity campaign, in which it has given some striking figures as to the present enormous production of coke oven gas and colliery electricity, the cheap rates at which it is produced, the large quantities available for sale, and the ease with which output could be increased. There are already in South Yorkshire a number of public undertakings which use coke oven gas. Principal among them is the Sheffield Gas Company, which has for years been taking large supplies from Tinsley Park, Orgreave, and Nunnery collieries. These supplies are now to be supplemented by large quantities from the new coke ovens of Thorncliffe Distillation, Ltd., at Smithy Wood, near Sheffield. A long-term contract has been entered into, and the new supply began last week.

A Well-merited Honour.

Dr. Percy Longmuir, of Sheffield, was the recipient of a well-deserved distinction at the opening meeting of the Sheffield Trades' Technical Societies. In recognition of his distinguished services and sympathetic help, extending over many years, to the workers engaged in the steel melting and foundry trades, the freedom of those industries was conferred upon him by Sir Henry Hadow, Vice-Chancellor of the University of Sheffield. The freedom was accompanied by a handsome silver medallion, specially designed by the Sheffield Silver Trade Technical Society, and inscribed. Dr. Longmuir took an active part in the formation of the Institution of British Foundrymen, of which he was President in 1910 and 1911. He is well known as a research worker in iron and steel metallurgy, and also as one keenly interested in the training of the worker. For some years he lectured to large audiences of iron and steel workers at the University.

Cutlery and Plate.

The reports to hand with regard to the cutlery and plate trades are more satisfactory than they have been for some time. Although conditions are mixed, and only a minority of firms is profitably employed, there has been a considerable seasonal increase in business, on both home and overseas account, and output has been growing since the opening of the present month. In stainless table cutlery prices are very competitive, and the demand is chiefly for the cheaper lines. Huge quantities are being supplied to the sixpenny bazaars. There is, however, also a fair call for goods of high quality, some makers of which are well placed for work. The demand for expensive ivory-handled cutlery this year has been on a larger scale than for some time previously, steamship companies having been good customers. There is an expanding trade in spoons and forks. Of the unplated and stainless steel kinds of these articles the Colonies are taking increased quantities. In table hollowware trade is but moderate, while sterling silver, although selling in considerable quantities, shows little progress. The safety razor branch of the cutlery trade continues very active.

Doncaster Developments.

Doncaster Corporation has in view a "north-west development scheme," for opening up a new industrial area in and immediately beyond the town, and this will be facilitated by the making of a new goods line by the L.N.E.R. Company, the first sod of which was cut by the Mayor last week. The line is being constructed primarily to bring railway facilities to the new artificial silk factory of British Bemberg, Ltd., on the Wheatley Park estate, but when necessary it will be extended across that estate and on to land belonging to the Corporation at Sandall. The factory site, which covers 80 acres, is near the L.N.E.R. line, but is separated from it by the river Don and a flood drain. The factory will, it is said, be opened in about six months, and it will employ 1200 persons at the outset, a number which is expected to be greatly increased in a few years. The main building measures 780ft. by 165ft., and, with subsidiary buildings, the total floor space will be 300,000 square feet; 4000 tons of steel are being used in the construction of the works.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

A QUIET tone now pervades the Cleveland pig iron market, and business has fallen off to some extent. Producers are probably not concerned about the immediate prospects regarding the disposal of their output, but the high costs of production are a most disturbing factor, and there are no prospects of an early reduction. Indeed, production cost is likely to be further increased over the last quarter of the year by advances of wages of blast-furnacemen and ironstone miners. The latter are submitting to the mineowners a scheme for new rates of pay which, it is computed, will mean an additional burden to the industry of fully £20,000 a year. Consumers of Cleveland pig iron claim that they can buy small quantities from second hands at a little below recognised market figures, but ironmasters adhere to their fixed minimum prices, and report a few further home sales to the end of the year. Prompt parcels do not command more than is accepted for forward supply. Export business is little heard of. Continental pig iron is competing successfully in certain markets against Cleveland iron, but consumers in this district are not buying from abroad. No. 1 Cleveland foundry is 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d.; and No. 4 forge, 71s.

Hematite Pig Iron.

The position in the East Coast hematite pig iron trade is very discouraging from the manufacturers' point of view. They declare that an early advance in prices is essential, and some are stocking iron rather than accept the unremunerative current rates. Merchants' holdings are not heavy, but they are unloading at below producers' quotations, which are based on ordinary qualities at 76s. 6d. Hematite is thus 4s. above Cleveland pig iron, whereas the pre-war normal difference was 8s. to 10s.

Ironmaking Materials.

Very little foreign ore is available for sale, and market rates remain strong at the equivalent of best Rubio at 24s. 6d. c.i.f. Tees. Consumers are heavily bought, and are holding off the market. Consumers of blast-furnace coke are experiencing difficulty in obtaining adequate supplies, and the scarcity threatens to be more acute. Good average qualities are quoted 23s 6d. to 23s. 9d. delivered at North-East Coast works, and makers are not anxious to sell, as they can readily secure higher figures for export.

Manufactured Iron and Steel.

Foreign competition is once more being experienced in the manufactured iron and steel trade in this area. For some months past manufacturers have been able to command most of the business in both finished and semi-finished materials, but as the result of reduced production costs continental firms are again entering into competition with British makers. Manufactured iron firms are busy, but new orders would be welcome. Semi-finished steel producers have a lot of work to turn out, and are not disposed to lower quotations, but comparatively cheap continental commodities are offered freely, and Northern firms are not doing much business. In the finished steel branches also manufacturers have to contend with underselling by foreign competitors. All quotations keep steady.

Blast-furnacemen's Wages Advanced.

As a result of the quarterly ascertainment issued by the Cleveland Ironmasters' Association this week an advance of 1 per cent. has been conceded to blast-furnacemen employed at North-East Coast ironworks. This brings the wages to 11·25 per cent. above the standard. The ascertained price of No 3 Cleveland pig iron, which

governs the wages under a sliding scale, for the past quarter was certified at 65s. 5·92d. per ton, an advance of approximately 1s. per ton, as compared with the realised price of the preceding three months.

Iron and Steel Imports.

Imports of iron and steel into the river Tees are once more on the increase. Statistics presented at this week's meeting of the Tees Conservancy Commissioners showed that during the past eleven months 174,929 tons were imported, as compared with 208,533 tons in the corresponding months of 1927–28, and 54,563 tons in the pre-war period of 1913–14. The imports of plates, bars, angles, joists, &c., are still on a big scale, totalling 42,997 tons, as against 43,482 tons in 1927–28, and 19,481 tons in 1913–14. The pig iron unloaded during the eleven months reached 28,263 tons, as against 6248 tons in 1927–28, and 1427 tons in 1913–14. Crude sheet bars, billets, blooms, slabs, &c., imported reached 103,669 tons, as against 158,803 tons and 33,655 tons respectively. During September 19,097 tons of iron and steel were brought into the port, as compared with 16,579 tons in September last year, and 1164 tons in the same month in 1914.

Order for Locomotives.

Robt. Stephenson and Co., Ltd., of Darlington, have received an order for twelve three-cylinder compound passenger tank locomotives for the Argentine. These engines, which are to be of the 4–6–4 type, are to be of a new design, and it is estimated that the weight, in working order, will be about 120 tons.

The Coal Trade.

The collieries in Northumberland and Durham are in a more favourable position this week in consequence of a much better supply of tonnage. Output and tonnage are more evenly balanced than they were last month. At this time of the year there is always the possibility of delays to steamers owing to bad weather, but assuming that interruptions of this kind are not pronounced, there is a likelihood of a quick clearance of all the coal that can be produced. The ordinary winter trade is expanding, and, with a sustained export business, the immediate prospects are encouraging. More attention is being given to forward buying, and the disposition is to take courage and cover well over next year. Northumberland steam coal is the strongest feature of the market. Under a pressing demand this fuel, which is in very scanty offer, is rising in value, and the basis is now 16s. 3d. to 16s. 6d. There is no alteration in other steam coal values, which, however, continue to be firm, Tyne primes being 15s. 6d. to 16s., and seconds 9s. 3d. to 9s. 6d. First grade Durham steam coal is also stiffly quoted at 18s. More settled conditions prevail in the Durham gas coal market than a week ago, and there are fewer turns available. Prices are maintained, best kinds being at 16s. 9d., specials at 17s. 6d., and seconds steady at 14s. 9d. to 15s. 6d. There continues to be a good offer of coking coal at 14s. 9d. to 15s., and of ordinary bunkers, which are somewhat dull, at 14s. 6d. to 15s. First-class bunkering fuel, however, is steadily situated at 16s. to 16s. 6d. The coke position remains very firm, and considerable shipments are in prospect. District producers of gas sorts have little to dispose of for this month. Makers' quotations for best qualities range from 24s. to 25s. Patent foundry cokes of all descriptions are in heavy request on both home and foreign account. Good brands command 25s. to 26s., whilst special foundry and beehive are nominal at 28s. to 33s. There is a sustained inquiry for blast-furnace coke and the price is exceedingly firm.

SCOTLAND.

(From our own Correspondent.)

Uncertain Outlook.

So far as the steel, iron and coal trades are concerned, the outlook for the winter months has not improved. Certain branches of the steel trade are active, but the outlook in the heavy departments is affected by the position in the shipbuilding industry, which is now less promising. Keen continental competition affects other branches, and there seems little hope of early relief. The iron trade is dull generally, and present indications hold small hope of improvement over the winter months. In the coal trade the position may be termed fair, but until the scheme in preparation to reorganise the industry is made public, exporters and owners alike are moving with great caution and forward transactions are more or less impossible in view of the present level of prices, which in all probability will be adhered to until the position is more definite.

Steel.

Makers of heavy steel have moderate commitments at present, but fresh specifications are slow to arrive, and prospects are less satisfactory. Steel sheets continue to improve, both for home and export demand, and some producers have now comparatively well-filled order books. Light sheets are better placed than the heavy gauges, but the latter are confidently expected to show an early expansion in demand. Export demands for flat and corrugated galvanised sheets continue to increase, and the position is now more normal for this season of the year. Tube makers are fairly well placed in all branches, and prospects are considered to be reasonably good for some time ahead, as some good inquiries have just come to hand which may be reasonably expected to result in good business. Prices, as a rule, are unchanged.

Iron.

Bar iron makers are having a very lean time, and the outlook is far from bright. The re-rolled steel bar department is little, if any, better, producers suffering from very keen foreign competition. Re-rolled steel bars are still quoted in the vicinity of £8 home and £7 15s. per ton export.

Pig Iron.

The restricted output of pig iron is still sufficient to cover demands, and business, though steady, is comparatively small. Prices remain unchanged at the recently agreed minimum rates.

Scrap

Scrap materials are a shade weaker for prompt sale, heavy steel being quoted about 75s., and heavy basic and heavy machinery about 70s. per ton. Forward business cannot be done at those prices however.

Coal.

The collieries in all districts are, as a rule, fairly well sold meantime, and apart from one or two descriptions of round coal, have practically nothing of any consequence available for immediate loading. Occasional lots have come on the market, through boats falling out of turn, but little difficulty is experienced in securing full current prices for such fuel. Lanarkshire ells and splints, Fifeshire first-class steams and washed materials in all districts are very firm. Lothians steams are perhaps more easily obtained, though nominal quotations are upheld. Forward inquiries from abroad are fairly numerous, but little business is being done, as neither the collieries nor the exporters can name prices low enough to induce business, as neither are inclined to take risks meantime. Aggregate shipments during the past week amounted to 269,851 tons, against 293,107 tons in the preceding week and 218,285 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

The immediate position in the steam coal trade is far from satisfactory, and numbers of collieries are working irregularly owing to the shortage in the prompt demand for large coals. It was reported that one important concern, which has worked without interruption throughout the whole of this year, has this week had temporarily to suspend operations as a consequence of the lack of empty wagons, and the accumulation of standing stocks. Fresh inquiry from abroad for early shipment is undoubtedly quiet, and yet the outlook for next year is regarded with less anxiety than was the case a year ago. It is true that the horizon is far from clear as regards labour troubles, but still there is the feeling that the difficulties between the coalowners and labour will be smoothed over before the end of the year. Rumours are current that labour's demand for shorter working hours will be met to some extent and that new agreements will be arranged without a crisis being reached with all that means to the detriment of business. There is no doubt that already more business has been done in Welsh coals over next year than was the case at this time last year. Reports are in circulation that sales have been effected for account of French railways and shipping undertakings for delivery over 1930 running into more than a million tons, while it is understood that the Paris–Orleans Railway has asked for prices for 50,000 tons of patent fuel, and that a further big inquiry is expected at the end of the month for supplies over next year. Tenders go in shortly for 200,000 tons of Welsh coals for the Brazilian Central Railway for delivery over the next four months, and news has come to hand that the Norte Railway of Spain has asked for tenders for 40,000 tons of Admiralty coals for delivery at various Spanish ports during November and December.

Tonnage and Freights.

Considering the shortage of tonnage at the disposal of collieries, shipments last week from this district cannot be accounted unsatisfactory. The feature was the loading pressure at Swansea, where steamers were waiting to berth, whereas at the other ports, where steam coals are mainly shipped, tonnage was in short supply and the daily returns showed that tipping appliances were idle. At the end of last week these returns revealed that twenty-nine tips were idle, while twenty vessels were waiting, but it should be pointed out that of the latter, nineteen were waiting at Swansea. Anthracite collieries are finding it difficult to cope with their commitments, and prices are firm all round, but when it comes to steam coals, it has to be admitted that all large coals are at the minimum prices, and that the irregularity of work at so many pits continues to cause a shortage in the supply of smalls and sized coals which command good prices. Chartering of tonnage has been below the average of late, and it is a peculiar fact that, while new orders for steam coals, particularly, are slow to mature, tonnage is equally on the scarce side, with the result that outward rates are surprisingly well maintained. The feature of the freight market for several weeks past has been the strength of the market for tonnage for Canada and South America. This condition has been brought about by the lack of homeward grain business, and those firms which have commitments in coal for South America especially have had to face very heavy losses, as they have had to pay 4s. to 5s. per ton above the figure which they estimated for tonnage when they entered into contracts. The combined loss of the various firms interested in South American business must run into thousands of pounds during the past month. Fortunately, this week the outward market for coal has shown definite indications of moving more in favour of charterers. As regards Canada, it is interesting to note that this week as much as 12s. per ton has been paid for a steamer for Montreal, whereas the average freight paid for this direction last year was 6s. 3d. Such a heavy advance in the coal rate for Canada does not, of course, enhance the prospects of extending business in British coals against the competition of American coals.

Tube Works Dispute.

Up to the time of writing, the position at the British Mannesmann Tube Works, Landore, Swansea, was unchanged, and all departments were idle as the result of the dispute referred to last week. About 500 men are out in opposition to the proposed wage reductions. At the end of last week the company was compelled to dismiss the engineers and fitters, numbering about 150 men, who up till then had been carrying on. The latest news, however, is that there are prospects of a speedy settlement of the trouble, as negotiations are proceeding satisfactorily to bring this about.

Ship-repairing.

The past week or so has witnessed very dull conditions in the repairing industry of this district. Naturally, the shortage of tonnage trading to South Wales to load coal adversely affects the interests of the ship-repairing undertakings. Conditions have not been any too good for some time past, but the last fortnight has proved the worst for one or two of the leading repairing concerns this year. For this reason, it is all the more satisfactory to see that Messrs. T. Diamond and Co., of Cardiff, have secured a useful contract for the repair of the damage sustained by the ss. "Wordsworth." This order was open for competition by Liverpool and North Country firms, as well as Bristol Channel undertakings. The job will take just over a fortnight to complete, and means much desired employment for boilermakers and other shipyard workers.

Additional Works for Newport?

Although no official information is forthcoming, the report is current at Newport that John Lysaght, Ltd., has decided to remove its Bristol galvanising sheet works to Newport. This company, as is well known, owns one of the largest undertakings in this industry at Newport, and it is estimated that the transfer of the Bristol works to the Uskside town will mean the employment of an additional 600 men, besides which it would naturally increase the import and export traffic at Newport Docks.

Current Business.

The tone of the market is quiet so far as large coals are concerned, and all classes are affected. There is no doubt that the operation of the minimum rate prevents prices falling. Whether the increase in the minimum prices has anything to do with the paucity in the demand is open to question, as it has to be admitted that the inquiry for all classes of large coals was far from satisfactory before the advance in the minimum took place. Stocks of large coals are so heavy that colliery working has been considerably interfered with of late, and this has accentuated the shortage in the supply of smalls and sized coals, which are as firm as ever. Coke continues to find a ready outlet, and patent fuel manufacturers are comfortably stemmed. Pitwood prices are depressed, owing to the difficulty of securing empty wagons.

Tin-plates for South Africa.

It is announced that rates of a more satisfactory character have now been agreed upon between South Wales manufacturers of tin-plates and the Conference Lines from the United Kingdom to South Africa. The present rate of freight for the carriage of tin-plates to Cape Town is 20s. per ton net. The proposal was that, as from November 1st, this should be increased to 50s. per ton for cases tin-lined and iron-hooped, 55s. per ton for cases tin-lined only, and 65s. per ton for cases iron-hooped only. These charges were later modified to the extent of 5s. per ton, but manufacturers continued their representations, and as the result the shipping lines have agreed to make a flat rate of 45s. per ton for all tin-plates, irrespective of the method of packing. The bulk of plates shipped from South Wales to South Africa are iron-hooped only, so that the effect of the new concession is to reduce the freight by 20s. per ton compared with what was originally proposed.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

Mr. R. H. Line asks us to announce that he has resigned from the position as chief engineer with the Branston Artificial Silk Company.

Mr. Harold E. Midgley, M. Inst. C.E., late director, chief engineer and general manager of the Foundation Company, Ltd., asks us to announce that he has resigned those positions to join the board of Rutha Steam Storage, Ltd.

Steam Plant Accessories, Ltd., of 38, Victoria-street, S.W. 1, asks us to announce that it has resigned from its representation of A. Turnbull and Co., Ltd., Glasgow, as from September 30th last.

C. F. Casella and Co., Ltd., ask us to announce that they have changed their address to Regent House, Southampton-street, Fitzroy-square, London, W. 1. Telephone, Museum 8084; telegrams, "Escutcheon Eusrosd-London;" cables "Escutcheon, London."

Mr. A. P. M. Fleming, of the Metropolitan-Vickers Electrical Company, Ltd., has been appointed by the Board of Directors of the American Institute of Electrical Engineers to be Honorary Secretary for England for the two-year term August, 1929, to August, 1931. Mr. Fleming succeeds Mr. C. le Maistre, whose term has just expired.

LAUNCHES AND TRIAL TRIPS.

Siamese Prince, twin-screw motor vessel; built by the Blythswood Shipbuilding Company, Ltd., to the order of Prince Line, Ltd.; dimensions, 460ft. by 60ft. by 42½ft.; to carry cargo. Engines, two sets Doxford opposed-piston type; constructed by Richardsons, Westgarth and Co., Ltd.; trial trip, September 27th.

Hindanger, twin-screw motor vessel; built by Sir W. G. Armstrong, Whitworth and Co. (Shipbuilders), Ltd., to the order of Westfal Larsen and Co. (A/S), Bergen; dimensions, 415ft. by 54ft. 6in.; to carry cargo. Engines, two sets single-acting Diesels; constructed by Messrs. J. G. Kincaid and Co.; trial trip, October 1st.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
(1) Native	19/6 to 22/-
(1) Spanish	26/- to 27/6
(1) N. African	26/- to 27/6
N.E. Coast—	
Native	18/- to 21/-
Foreign (c.i.f.)	24/9

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	4 0 0	—
No. 1 Foundry	3 18 6	—
No. 3 Foundry	3 16 0	—
N.E. Coast—		
Hematite Mixed Nos.	3 16 6	3 16 6
No. 1	3 17 0	3 17 0
Cleveland—		
No. 1	3 15 0	3 15 0
Silicious Iron	3 15 0	3 15 0
No. 3 G.M.B.	3 12 6	3 12 6
No. 4 Foundry	3 11 6	3 11 6
No. 4 Forge	3 11 0	3 11 0
Mottled	3 10 6	3 10 6
White	3 10 6	3 10 6
Midlands—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	—	—
(3) Northampton—		
Foundry No. 3	3 15 0	—
Forge	3 11 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 13 6	—
No. 4 Forge	3 9 6	—
Basic	—	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 7 6 (*a*); 4 9 6 (*b*); 4 13 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
Lancs.—		
Crown Bars	10 15 0	—
Second Quality Bars	9 15 0	—
Hoops	13 0 0	—
S. Yorks.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
Midlands—		
Crown Bars	10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	—
Gas Tube Strip	11 2 6	—

STEEL (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates (Marine)	10 10 0	10 10 0
,, ,, (Land)	10 0 0	10 0 0
Ship Plates, ¾in. and up	8 12 6	7 12 6
Sections	8 2 6	7 2 6
Steel Sheets, ⅛in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	13 10 0	13 7 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 12 6	—
Angles	8 2 6	—
Boiler Plates (Marine)	10 10 0	—
,, ,, (Land)	10 0 0	—
Joists	8 2 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
Manchester—		
Bars (Round)	9 2 6	—
,, (Small Round)	8 5 0 to 8 7 6	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
,, (Lancs. Boiler)	9 17 6	—
Sheffield—		
Siemens Acid Billets	9 10 0	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	7 0 0	—
Hoops	9 15 0 to 10 5 0	—
Soft Wire Rods	8 2 6	—
Midlands—		
Small Rolled Bars	8 2 6 to 8 15 0	—
Billets and Sheet Bars	6 7 6 to 6 12 6	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 7 6 to 13 10 0	—
Angles	8 2 6	—
Joists	8 2 6	—
Tees	9 2 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	19/- to 19/3
Block Tin (cash)	195 10 0
,, ,, (three months)	200 10 0
Copper (cash)	74 13 9
,, (three months)	75 1 3
Spanish lead (cash)	23 5 0
,, ,, (three months)	23 8 9
Spelter (cash)	23 15 0
,, (three months)	24 1 3
Manchester—	
Copper, Best Selected Ingots	80 5 0
,, Electrolytic	84 15 0
,, Strong Sheets	110 0 0
,, Tubes (Basis Price), lb.	0 1 3
Brass Tubes (Basis Price), lb.	0 1 1
,, Condenser, lb.	0 1 3
Lead, English	24 17 6
,, Foreign	23 10 0
Spelter	24 0 0
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/6½ per lb.	
Ferro Tungsten	3/3½d. per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/6
,, ,, 6 p.c. to 8 p.c.	£22 10 0	7/-
,, ,, 8 p.c. to 10 p.c.	£21 10 0	6/6
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£32 0 0	12/-
,, ,, ,, 1 p.c. carbon	£37 0 0	15/-
,, ,, ,, 0·70 p.c. carbon	£40 0 0	17/-
,, ,, ,, carbon free	1/2 per lb.	
Metallic Chromium	2/6 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home; £13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/- per unit	
,, ,, 75 p.c.	£19 10 0 scale 6/- per unit	
,, Vanadium	13/- per lb.	
,, Molybdenum	4/- per lb.	
,, Titanium (carbon free)	11d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/4 per lb.	

FUELS.

SCOTLAND.
(*Prices not stable.*)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	14/-
,, ,, Ell	16/-
,, ,, Splint	16/9 to 18/-
,, ,, Trebles	16/- to 16/6
,, ,, Doubles	16/-
,, ,, Singles	13/6 to 14/-
Ayrshire	
(f.o.b. Ports)—Steam	13/6
,, ,, Jewel	16/-
,, ,, Trebles	17/6
Fifeshire—	
f.o.b. Methil or Burntisland—Steam	12/6 to 15/6
Screened Navigation	17/6 to 18/6
Trebles	17/6 to 18/-
Doubles	16/-
Singles	14/-
Lothians—	
(f.o.b. Leith)—Best Steam	14/-
Secondary Steam	13/6
Trebles	17/6
Doubles	16/-
Singles	13/9 to 14/-

ENGLAND.

	Inland.
(8) N.W. Coast—	
Steams	21/6 to 22/-
Household	38/- to 51/-
Coke	26/6 to 27/6
Northumberland—	
Best Steams	16/3 to 16/6
Second Steams	15/- to 15/6
Steam Smalls	10/- to 10/6
Unscreened	13/- to 13/6
Household	25/- to 37/-
Durham—	
Best Gas	16/9
Second	15/6 to 16/-
Household	25/- to 37/-
Foundry Coke	25/- to 30/-
Sheffield	Inland.
Best Hand-picked Branch	26/6 to 28/-
Derbyshire Best Bright House	21/- to 23/-
Best House Coal	20/6 to 21/6
Screened House Coal	18/6 to 20/-
,, ,, Nuts	16/6 to 18/-
Yorkshire Hards	15/6 to 17/-
Derbyshire Hards	15/6 to 17/-
Rough Slacks	9/- to 10/-
Nutty Slacks	7/- to 8/-
Smalls	3/- to 5/-
Blast-furnace Coke (Inland)	14/6 at ovens
Furnace and Foundry Coke (Export), f.o.b.	23/- to 24/-

(9) SOUTH WALES.

	Inland.
Cardiff—	
Steam Coals:	
Best Smokeless Large	20/- to 20/3
Second Smokeless Large	18/9 to 20/-
Best Dry Large	19/- to 19/3
Ordinary Dry Large	17/9 to 18/3
Best Black Vein Large	18/3 to 18/6
Western Valley Large	17/9 to 18/-
Best Eastern Valley Large	17/9 to 18/3
Ordinary Eastern Valley Large	17/6 to 17/9
Best Steam Smalls	14/3 to 14/6
Ordinary Smalls	13/- to 14/-
Washed Nuts	19/6 to 20/-
No. 3 Rhondda Large	20/3 to 21/-
,, ,, Smalls	15/6 to 16/-
No. 2 ,, Large	17/3 to 17/6
,, ,, Through	15/6 to 16/6
,, ,, Smalls	14/3 to 14/9
Foundry Coke (Export)	30/- to 37/-
Furnace Coke (Export)	27/6 to 30/-
Patent Fuel	22/-
Pitwood (ex ship)	27/6 to 28/6
Swansea—	
Anthracite Coals:	
Best Big Vein Large	34/- to 37/6
Seconds	28/6 to 30/6
Red Vein	24/- to 27/6
Machine-made Cobbles	42/- to 45/-
Nuts	40/- to 45/-
Beans	23/6 to 25/6
Peas	19/- to 19/6
Breaker Duff	9/9 to 10/-
Rubbly Culm	11/3 to 11/9
Steam Coals:	
Large	18/- to 19/-
Seconds	17/- to 18/
Smalls	11/6 to 13/6
Cargo Through	15/6 to 16/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum) 12/6 Ordinary Ship, Bridge and Tank Plates and Sections 10/- if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

Import Restrictions.

At the Geneva economical conferences all the nations adhered in principle to the abolition of restrictions upon imports and exports, and yet competition has reached such a point that manufacturers in France are seriously considering the necessity of doing something to protect themselves from the importation of American goods. On account of the steady decline in export values, manufacturers see that their future depends upon keeping the home market to themselves, especially in view of the prevailing activity which, it is hoped, will be continued by the carrying out of public works and by the execution of the programme for colonial development. At a time when the United States threatens to oust European products entirely, manufacturers on the Continent regard with some disfavour the apparently successful attempts of American firms to sell their goods in Europe. Matters have come to a crisis now that the Motor Show in Paris has made it plain that American competition in motor cars is a very real factor that must be taken definitely into account. The past year has seen the American organisation steadily developing, and the sales of American cars are increasing. During the Show there is to be a meeting of European motor car manufacturers to decide upon what action shall be taken to defend their interests. It is proposed to induce the various Governments to limit the imports of American cars to the value of the respective countries' similar products sent to the United States. If it is found possible to do this in the case of motor vehicles, it is hoped to extend the system to all manufactured goods, so that there will be a "balance of trade" between the Continent and the U.S.A.

Cultivating Machines.

In a country in which a national agricultural industry is being hampered by a scarcity of labour and rising costs, the use of the tractor for tillage and general farm purposes is becoming indispensable, but the difficulty of producing machines suitable for small farms, which are in the great majority all over France, has so far limited the employment of tractors. It is affirmed that the agricultural industry can only be saved from decline by the introduction of small and economical power tillage machines, the market for which is considerable. The Comité Central de Culture Mécanique is a State organisation which holds every year a demonstration of tractors and other machines, and the meeting last week near Versailles, though for the most part spoilt by the bad weather, was remarkable for bringing together more than thirty makers, including many from the United States, Canada, England, Germany, Italy, Sweden and Czecho-Slovakia. After many years of fluctuating fortunes when, at times, it appeared doubtful whether any real practical results would be achieved with types of machines that have to work under extremely arduous conditions, the tractor industry is now firmly established, but there is still much to be done before such machines can come into general employment by the smaller users. The trouble has arisen mainly out of the fuel cost. The only thing that interests the farmer is the cost of tilling his land. The price of petrol in France is so high that the tractor designer must either get his petrol consumption down very low or he must use cheaper fuels. There is, consequently, a considerable variety in the types of tractors, some using petrol, others starting on petrol and then turning on to paraffin, and others again having hot bulb engines for burning any kind of heavy oil. At the demonstrations, there were a few machines with charcoal suction gas plants, but they have failed to meet with any success amongst agriculturists at home, although a good many suction gas vehicles are sent to the Colonies. Except for the smallest types of machines the use of petrol is hardly likely to favour the development of the tractor industry, and some of the motor car firms fit heavy oil engines to their tractors, while the feature of the meeting last week was the number of German machines, nearly all with hot bulb engines, some of them being of the horizontal single-cylinder two-cycle type. The extremely low running costs obtained with these machines encourages the belief that the future of the agricultural tractor lies in the heavy-oil engine. At present, the initial costs of these machines is higher than that of the French petrol or paraffin tractors, in which attempts are made to reduce consumption by lessening the weight of the vehicle and depending upon some mechanical devices, other than the road wheels, for utilising more of the engine power on the drawbar. There is, of course, the endless track which is largely employed, and another system is to drive by means of inside wheels with plates, which hold on to any soil without slipping and which are raised when the vehicle has to travel on the road. The field for research is so considerable, especially in view of the varied conditions under which tractors have to work, that there are obviously great possibilities of development; but, for the first time, the machines exhibited last week were all of practical design, and were capable, under most conditions, of fulfilling the needs of agriculturists. The objection to any packing of the soil by tractors appears to have been overcome by presenting tractors of somewhat lighter build and distributing the load over a sufficiently large wheel surface. This limits the use of the tractor to ploughing to depths of about 6in. with two or three shares, and it cannot supersede the cable for deep ploughing. At the demonstration the only deep cultivation was done by electric cable sets. The petrol-engined ploughing tackles that were at one time constructed by French makers, have been abandoned, probably on account of the fuel cost, and nothing more has been done with that type of cultivating gear in France, because every encouragement is given to electric ploughing in the belief that with rural electrification farmers will be able to rely upon that source of energy for tillage operations. The success of electric cultivation will necessarily depend upon the cost at which the energy is supplied to farmers. Already the cost of distribution in rural districts is found to be greater than had been anticipated, and another difficulty is that, it would not pay the companies to install mains of far greater capacity than is required for normal consumption.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

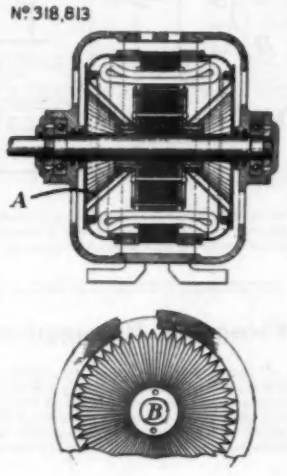
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

318,813. June 5th, 1928.—Electric Motors and Dynamo Machines, Carl Livingston Daun, of 57, Erie-street, Milwaukee, Wisconsin, U.S.A.

According to this invention, the air impellers are replaced by runners or members enclosing the ends of the machine. Each of these members consists of a fluted disc portion A and a hub portion

Nº 318,813

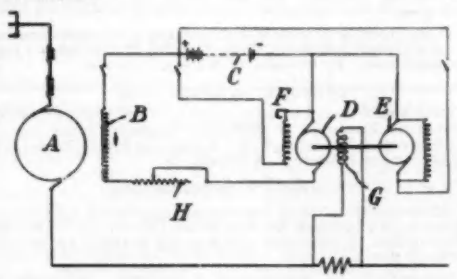


B. The pleats or flutes provide a large cooling area. It will be understood that these end members revolve. The inventor claims to have produced a fully enclosed motor having the same horse-power per pound weight as an open type motor. Moreover, in accordance with the invention, a motor of the latter type can readily be converted into an enclosed machine.—*September 5th*, 1929.

318,357. July 28th, 1928.—Dynamo-electric Machines, The English Electric Company, Ltd., of Queen's House, 28, Kingsway, London, W.C. 2; John Earnshaw Calverley, of Parklands-avenue, Penwortham, Preston, Lancashire; and Wilfrid Donnelly, of 262, Hornby-road, Blackpool, Lancashire.

This invention relates to a method of controlling the voltage characteristic of an electric generator driven by a prime mover, such as an internal combustion engine, so as to utilise advantageously the speed-torque characteristics of the prime mover irrespective of the current load on the generator, thereby keeping the generator power output constant. The main generator A, having compensating and interpole windings, is provided with a field winding B separately excited from a source of substantially contant potential C, which may be a battery, in series with a booster D. The booster D is driven at substantially constant speed by a machine E, which in turn is conveniently driven from the battery C. The booster is provided with a field winding F separately excited to saturation from the battery, which produces in the booster armature a voltage which is additive to that of the battery. The booster is also provided with an opposing series field winding G, which carries the variable load current of the main generator A or a current proportional thereto. When the main generator is on low current

Nº 318,357



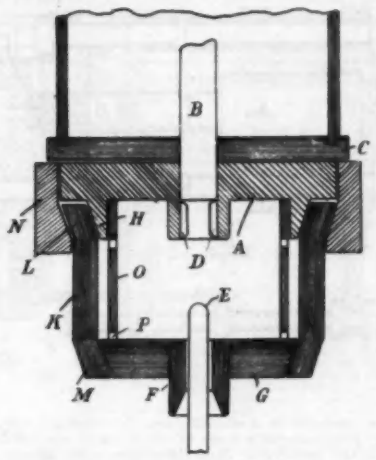
loads the battery C and the armature of the booster D assist one another to produce a strong main generator field. As the main generator current increases the booster series field winding G becomes more and more effective to demagnetise the booster field, and at a certain value of generator current the voltage of the booster D is reduced to zero and at higher generator current values the booster voltage reverses so that it opposes the voltage of the battery. The shape of the resulting load characteristic curve of the main generator A is one in which the voltage, starting from a certain predetermined high value at zero load current, droops gradually to, say, about 90 per cent. of its original value, when the load is equal to the full load of the prime mover, and afterwards, as the load current increases, the load characteristic conforms approximately to the shape of a rectangular hyperbola until the load current becomes great enough to begin to saturate the field system of the booster D, i.e., when the ampère turns of winding G are double those of winding F. When the field of the booster D is reversed owing to increasing main load current, and the booster voltage passes through zero, the booster changes over from a generator to a motor. Though the prime mover may be run normally at its full rated speed, it is usually required in addition to work at two or three lower speeds, and it is on that account that the self-contained motor generator booster set D and E is employed to regulate the excitation of the main generator.—*September 5th*, 1929.

SWITCHGEAR.

300,650. November 13th, 1928.—Explosion Pots for Oil Switches, *International General Electric Company, Incorporated, of* 120, *Broadway, New York.*

This invention relates to explosion pots for oil switches and provides a construction which is capable of withstanding the high electric and mechanical stresses to which extinguishing chambers are usually subjected. A represents the metallic cover of the explosion pot into which is screwed the bolt B which passes through the bushing end C. The cover A carries the contacts D which co-operate with the pin contact E passing through the guide bush F in the base G. The metallic cover has a screw thread cut on its periphery and is provided near its edge with an extension H, which has its outside face tapered. The explosion pot K is constructed of cardboard and is formed as a hollow cylinder having an outwardly tapering portion L and an inwardly tapering portion M. The part L has a taper corresponding to

Nº 300,650



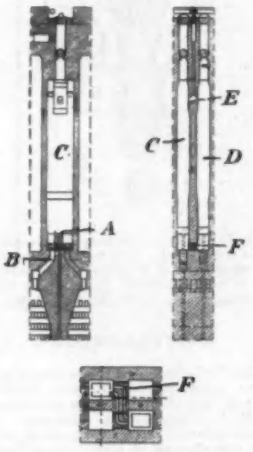
that of the extension H and is gripped between the latter and a nut N, screwed on to the cover A, while the other end of the pot has its taper corresponding to that of the end G, which is thus firmly wedged in position. The end G and the bush F may also be constructed of cardboard and can be caked together after the bush has been fitted into place, with an insulating material, such as that known under the registered trade mark "Bakelite." In order to protect the explosion pot wall against damage by the arc and the hot oil gases, a paper cylinder O is fitted, which can be changed without much cost or trouble. By means of the openings P the space between the two cylinders can also be filled with oil.—*September 5th*, 1929.

GAS PRODUCERS.

318,448. December 17th, 1928.—Vertical Coke Ovens, C. A. Baglin, 55, Dunkeld-road, Ecclesall, Sheffield.

This invention is concerned with the heating flues of vertical coke ovens, and aims at increasing the length of the flame so as to equalise the heating effect. The combustible gas is introduced at A and the air at B. Combustion proceeds to a certain extent in the upcast flue C and is continued in the downcast D

Nº 318,448



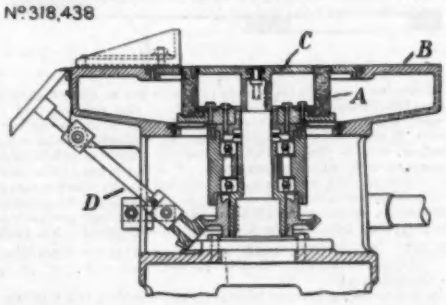
after the gases have passed through the burner hole E. Near the bottom of the partition wall there are arranged special blocks F, which are ported to by-pass some of the products of combustion back into the upcast flue and so delay the process of combustion. These blocks are made in three pieces, as shown, so that by sliding them one on the other the effective area of the passages may be altered and the volume of gas by-passed controlled.—*September 5th*, 1929.

MACHINE TOOLS AND SHOP APPLIANCES.

318,438. November 27th, 1928.—Grinding Machines, T. Oldfield, 37D, Beverley-terrace, Boothtown-road, Halifax, Yorks.

This invention is concerned with that type of grinding machine

Nº 318,438



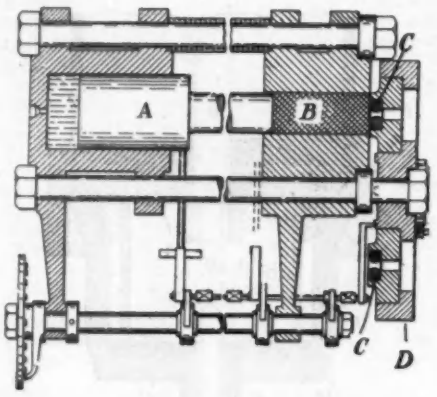
in which an annular abrasive wheel A protrudes through the top face of a table B and is used for grinding flat surfaces. It

is pointed out that with such a machine it is difficult to obtain a truly flat ground surface on account of the work piece tilting as it passes over the wheel. As a consequence, the inventor makes the centre part of the table C adjustable vertically by means of the gear D so that it may be set to suit the depth of cut being made.—*September 5th*, 1929.

318,113. February 27th, 1928.—Extrusion Presses, A. Kreidler, 1, Gansheiderstrasse, Stuttgart, Germany.

In this extruding press the process may be carried on more continuously than with the ordinary arrangement. The pressing ram is shown at A and the billet at B. There are two extrusion

No 318,113

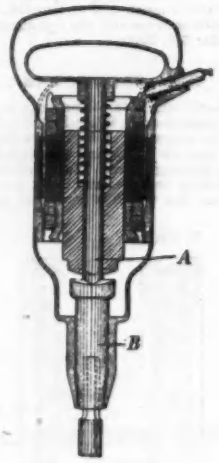


dies C C mounted on a rotatable arm D, which are used alternately. While one die is in use the other can be cleaned and prepared for the next cycle. In an elaboration of the idea two billet receivers are used and are worked alternately, so that one may be cleaned while the other is pressing.—*August 27th*, 1929.

318,458. January 25th, 1929.—Electrically Operated Hammers, E. H. W. Weibull, Saltsjöbaden, Sweden.

This invention involves the employment of an electric motor the rotor of which is made of considerable length as compared

No 318,458



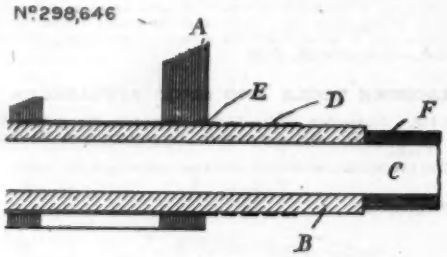
with that of the stator, so that it may move axially without disturbing the field conditions. This rotor is mounted on a spindle A, the end of which has a V bevel. The bevel works in conjunction with a corresponding V notch in an anvil B that actuates the striking tool.—*September 5th*, 1929.

MISCELLANEOUS.

298,646. October 12th, 1928.—Arrangement for Preventing the Corona on the Slot Sleeves of High-voltage Electrical Machines, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemenastadt, Germany.

This specification describes an arrangement for preventing the corona on the slot sleeves of high-voltage electric machines, characterised by the fact that the ends of the slot sleeves projecting out of the iron body are provided with a coating which is conductively connected with the iron body, and the length,

No 298,646

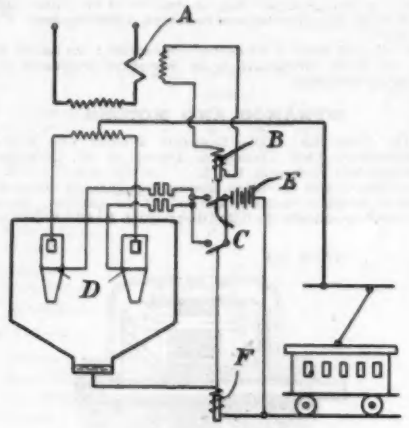


thickness and specific resistance of which are so chosen that the potential difference between the end of the coating and the copper winding is below the corona limit. A is the group of plates, B the sleeve of insulating woven material, C the copper winding, and D the conducting coating which is conductively connected at E with the iron body. F is the cover of the end of the winding. The coating can be applied in any known manner to the upper surface of the winding as, for example, by painting, electrolysis, or other suitable manner. It consists preferaby of finely divided material, such as graphite.—*September 5th*, 1929.

287,877. March 27th, 1928.—Mercury Vapour Rectifiers, Aktiengesellschaft Brown, Boveri and Cie., of Baden, Switzerland.

In the event of a short circuit in the rectifier, the current in the current transformer A operates the relay B and causes the switch C to close. This causes the grids D to be connected to the negative pole of the battery E, the positive pole of which is connected to the cathode so that the arc formed by the short circuit will be extinguished not later than the time corresponding to half a period of the alternating current. The device will

No 287,877



also come into operation in the event of an excess current in the continuous-current network, the relay F closing the switch C and causing the arc to be extinguished.—*August 27th*, 1929.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

TO-DAY.

Institute of Metals: Sheffield Local Section.—In the Non-ferrous Section of the Applied Science Department of the University, St. George's-square. "Some Notes on the Selection of Suitable Metals to Resist Corrosion," by Mr. F. C. Robinson. 7.30 p.m.

Institution of Engineering Inspection.—At the House of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "The Chemical Laboratory in Inspection," by Mr. E. F. Law. Illustrated by lantern slides and exhibits. 5.30 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. "Coal and Coal Cleaning," by Mr. R. H. Allen. 7.30 p.m.

Manchester Association of Engineers.—The Engineers' Club, Albert-square, Manchester. Opening address, "Developments in Power Production," by Mr. James A. Robertson. 7.15 p.m.

Society of Chemical Industry: Chemical Engineering Group.—In the Rooms of the Chemical Society, Burlington House, Piccadilly, London, W. 1. "Rationalisation: Its Meaning and Application, with special reference to the Chemical Industry," by Mr. J. Davidson Pratt. Discussion. 8 p.m.

MONDAY, OCTOBER 14TH.

Institute of Metals: Scottish Local Section.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. Address by Mr. H. H. A. Greer. 7.30 p.m.

Institute of Transport.—In the Lecture Theatre of the Institution of Electrical Engineers, Victoria Embankment, London, W.C. 2. Sir Josiah C. Stamp, G.B.E., will be inducted as President by Air Vice-Marshal Sir W. Sefton Brancker, K.C.B., the retiring President, and will deliver his opening address. 5.30 p.m.

Institution of Automobile Engineers: Scottish Centre.—At the Royal Technical College, Glasgow. "The Member and the Institution," by Professor W. Morgan. 7.30 p.m.

TUESDAY, OCTOBER 15TH.

Chadwick Public Lectures, London, 1929.—In the Lecture Hall of the Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. Lecture on "Sewage and Sewage Disposal," by Mr. Arthur J. Martin. 8.15 p.m.

WEDNESDAY, OCTOBER 16TH.

Electroplaters' and Depositors' Technical Society.—Northampton Institute, St. John-street, Clerkenwell. "Recent Development in Protective Coatings for Metals," by Mr. H. Sutton. 8.15 p.m.

Institution of Automobile Engineers: Birmingham Graduates.—Queen's Hotel, Birmingham. "The Heat Treatment of Carbon Steels," by Mr. J. G. Remington. 7.30 p.m.

Institution of Civil Engineers: Manchester and District Association.—In the Rooms of the Manchester Literary and Philosophical Society, 36, George-street, Manchester. Address by Alderman F. J. West. 6.45 p.m.

Overhead Lines Association.—At the Institution of Electrical Engineers, Savoy-place, London, W.C. 2. Annual general meeting, after which a discussion will take place on "Wayleave Agreements." 5.30 p.m.

Rugby Engineering Society.—Benn Buildings, Rugby. "Rationalisation of Industry," by Mr. A. P. Young. 7.30 p.m.

THURSDAY, OCTOBER 17TH.

Chadwick Public Lectures, London, 1929.—In the Lecture Hall of the Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. Lecture on "Sewage and Sewage Disposal," by Mr. Arthur J. Martin. 8.15 p.m.

Institution of Automobile Engineers.—Connaught Rooms, Great Queen-street, London. Annual dinner. 7 p.m.

THURSDAY TO SATURDAY, OCTOBER 17TH TO 26TH.

Society of Motor Manufacturers and Traders.—Olympia, Kensington, W. Twenty-third Automobile Exhibition. 10 a.m. to 10 p.m. daily.

FRIDAY, OCTOBER 18TH.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London. Presidential address by Mr. Daniel Adamson. 6 p.m.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Informal meeting. "Some Recent French Railway Construction," by Mr. M. A. Willox. 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Bolbec Hall, Newcastle-upon-Tyne. Annual general meeting. Presidential address by Mr. Launcelot E. Smith. 6 p.m.

West of Scotland Iron and Steel Institute.—Royal Technical College, George-street, Glasgow. Presidential address by Mr. Robert Hamilton. 7 p.m.

SATURDAY, OCTOBER 19TH.

Hull Association of Engineers.—In the Municipal Technical College, Hull. "Modern Improvements in Wireless," 7.15 p.m.

MONDAY, OCTOBER 21ST.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London. Graduates' Section. "Safety in Flight," by Mr. S. Scott Hall. 7 p.m.

TUESDAY, OCTOBER 22ND.

Institution of Engineers and Shipbuilders in Scotland.—39, Elmbank-crescent, Glasgow. "The Steam Turbine Locomotive," by Mr. James MacLeod. 7.30 p.m.

WEDNESDAY, OCTOBER 23RD.

Institution of Automobile Engineers: North of England Centre.—Engineers' Club, Albert-square, Manchester. "The Member and the Institution," by Professor W. Morgan. 7 p.m.

Institution of Municipal and County Engineers.—Institution Meeting. The East Midland District at Derby.

Newcomen Society.—At the Science Museum, South Kensington, S.W. 7. "Valve Gear of the Newcomen Engine," by Mr. C. O. Becker and Mr. A. Titley; also, "Josiah Hornblower and the First Steam Engine in America," by Mr. L. F. Loree. 5.30 p.m.

THURSDAY, OCTOBER 24TH.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, London, W.C. 2. Opening address by Colonel Sir T. F. Purves. 6 p.m.

Royal Aeronautical Society.—At the Royal Society of Arts, John-street, Adelphi, W.C. 2. "The Art of Flying Land and Sea Machines," by Captain N. Macmillan. 6.30 p.m.

FRIDAY, OCTOBER 25TH.

Faraday House Old Students' Association.—Twenty-first annual dinner at the Savoy Hotel.

Institution of Chemical Engineers.—In the Lecture Theatre of the Institution of Civil Engineers, Great George-street, Westminster, S.W. 1. "The Fabrication of Acid-resisting Steel Plant," by Dr. W. H. Hatfield. 6.30 p.m.

Institution of Electrical Engineers: North-Eastern Students' Section.—At Armstrong College, Newcastle-on-Tyne. Address on "The Work of the British Electrical Development Association." 7.15 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London. Informal meeting. "The Requirements of Overseas Locomotive Engineers in Respect of Locomotive Design and Details," introduced by Mr. P. C. Dewhurst. 7 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. "Electric Welding as Applied to Bridges and other Structures on the London and North-Eastern Railway," by Mr. Harold Bruff. 7.30 p.m.

MONDAY, OCTOBER 28TH.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, London, W.C. 2. Informal meeting. Discussion on "Systematic Research by Industrial Undertakings."

FRIDAY, NOVEMBER 1ST.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London. Thomas Hawksley Lecture, "Critical Relations Between Water and Steam," by Professor H. L. Callendar, F.R.S. 6 p.m.

TUESDAY, NOVEMBER 5TH.

Institution of Automobile Engineers.—Joint meeting with the Iron and Steel Institute at the Royal Society of Arts, John-street, Adelphi, W.C. 2. "Automobile Steels," by Dr. W. H. Hatfield. 7.45 p.m.

Institution of Automobile Engineers.—Broadway Café, Coventry. Birmingham Graduates. Joint meeting with the Coventry Graduates. Discussion. "That Mass Production is Detrimental to the Industry." 7.15 p.m.

THURSDAY, NOVEMBER 7TH.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, London, W.C. 2. "The Analysis and the Measurement of the Noise Emitted by Machinery," by Mr. A. G. Churcher and Mr. A. J. King. 6 p.m.

FRIDAY, NOVEMBER 8TH.

Illuminating Engineering Society.—32, Victoria-street, London, S.W. 1. "Modern Incandescent Lighting in Kinema Studios," by Messrs. W. H. Villiers and S. G. Double. 7 p.m.

TUESDAY, NOVEMBER 12TH.

Institute of Marine Engineers.—85–88, The Minories, London, E.C. 3. "The Opposed-piston Oil Engine," by Mr. J. Harbottle. 6.30 p.m.

THURSDAY, NOVEMBER 21ST.

British Waterworks Association.—Public Works Congress at the Agricultural Hall, London. Papers: "Water Supply as a Factor in Town and Regional Planning," by Mr. G. L. Pepler, F.S.I.; "The Preservation of Rivers and Streams from the Standpoint of Water Supply: Some Observations on River Pollution," by Dr. J. B. Firth; "The Purity of Drinking Waters from a Biological Aspect," by Dr. W. Rushton.

The Engineering Golfing Society.—The Autumn Meeting of the Engineering Golfing Society was held at West Hill, Brookwood, on Thursday, October 3rd. In the morning there was an eighteen-hole medal round, and the "Hele-Shaw" Scratch Challenge Cup and Memento were won by Squadron Leader C. H. Hayward, with a score of 75. The handicap prizes were taken as follows:—First Division, handicaps 10 and under: the "F. J. Walker" Challenge Cup and Memento by H. J. Taylor, with 83 — 9 = 74; and second prize, C. W. Myddleton, with 82 — 2 = 80. Second Division, handicaps 11 and over: The "P. B. Brown" Challenge Cup and Memento, by S. E. Page, with 96 — 14 = 82; and second prize, K. W. Macnee, with 100 — 17 = 83. The prize for the best first nine holes fell to J. H. Skelton and the prize for the best second nine holes to C. Stewart. In the afternoon there was an eighteen-hole round, foursomes against bogey, when the "Hadfield" Challenge Cups and Mementoes were won by G. H. Hopewell and G. V. Twiss with 1 up, the second prizes going to J. B. Marr and B. J. Hall with 2 down.